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SYSTEMATIC REVIEW OF THE TEXAS POCKET GOPHER, *GEOMYS PERSONATUS* (MAMMALIA: RODENTIA)

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Abstract

The Texas pocket gopher (*Geomys personatus*), which occupies a range in southern Texas and extreme northeastern Tamaulipas, was examined for morphological variation. Univariate and multivariate analyses were used to determine age, secondary sexual, individual, and geographic variation. Significant differences were found among the three age classes and between the sexes for 12 of 13 cranial measurements. Males displayed higher individual variation than females. Distributions of the six previously recognized subspecies (*fallax, fuscus, maritimus, megapotamus, personatus,* and *streckeri*) were examined. An additional subspecies is recognized and described. Of the seven subspecies of *G. personatus, fuscus* and *streckeri* form a group distinct from other subspecies.

Introduction

The Texas pocket gopher, *Geomys personatus,* which is restricted to South Texas and the coastal beaches of Tamaulipas, was described by True (1889) from specimens taken on Padre Island, Texas. Subsequently, Merriam (1895) described *G. p. fallax* and Goldman (1915) described *G. p. tropicalis*. Davis (1940) published the first major re-

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vision of the species and described four additional subspecies—*fuscus, maritimus, megapotamus,* and *streckeri* (changed from *minor* by Davis, 1943). Alvarez (1963) subsequently recognized *tropicalis* as a distinct species and this has been confirmed by later studies (Davis et al., 1971; Selander et al., 1975). Therefore, the recognized subspecies of *G. personatus* at the beginning of the current study included *fallax, fuscus, maritimus, megapotamus, personatus,* and *streckeri* (Hall, 1981).

Since the work of Davis (1940), several authors have commented on the need to reexamine the systematics and taxonomy of the species. Kennerly (1954) compared morphometrics and habitats of five subspecies, using eight samples and 342 specimens. He concluded local differentiation exists among populations with a cline of smaller-sized individuals with increased distance from the coast. Davis et al. (1971) reported karyotypic data from 18 localities throughout the range of *G. personatus*. For five subspecies examined, the diploid number ranged from 68 to 72, and the fundamental number from 70 to 76. Parasite data indicate speciation has occurred in the lice found on *G. personatus* (Price and Emerson, 1971; Price and Hellenthall, 1975; Timm and Price, 1979). *Geomydoecus texanus* has been reported from all subspecies except *G. p. fuscus* and *G. p. streckeri,* which are hosts to *Geomydoecus dalgleishi* and *Geomydoecus truncatus,* respectively.

This study is based on an analysis of greater numbers of specimens than were available to Davis (1940) and Kennerly (1954). Furthermore, additional populations, reported as range extensions for Karnes Co. in Texas (Kennerly, 1958*a*) and coastal Tamaulipas (Selander et al., 1962) were not included in previous analyses of geographic variation. Study of the 1051 available specimens, many of which were obtained by the authors, affords for the first time a detailed description of nongeographic and geographic variation in this species using univariate and multivariate statistical techniques. This is the fourth in a series of papers describing morphological variation in members of the genus *Geomys* (Williams and Genoways, 1977, 1978, 1980).

METHODS

Three external and 13 cranial measurements were taken from specimens examined. External measurements (total length, length of tail, length of hind foot) used were those initially recorded by the collector. Cranial measurements were recorded as described by Williams and Genoways (1977) and were taken by means of dial calipers, accurate to one-tenth of a millimeter. Males and females were separated and then assigned to one of three age groups as described by Williams and Genoways (1977).

For analysis of geographic variation, adult specimens were grouped into 16 samples as follows (Fig. 1): *sample 1*—Kinney and Val Verde cos.; *sample 2*—Dimmit and Zavala cos.; *sample 3*—La Salle Co.; *sample 4*—western Webb and western Zapata cos.; *sample 5*—Brooks, Duval, Jim Hogg, and eastern Webb cos.; *sample 6*—mainland of northern Kenedy and southern Kleberg cos.; *sample 7*—Cameron, Hidalgo, southern

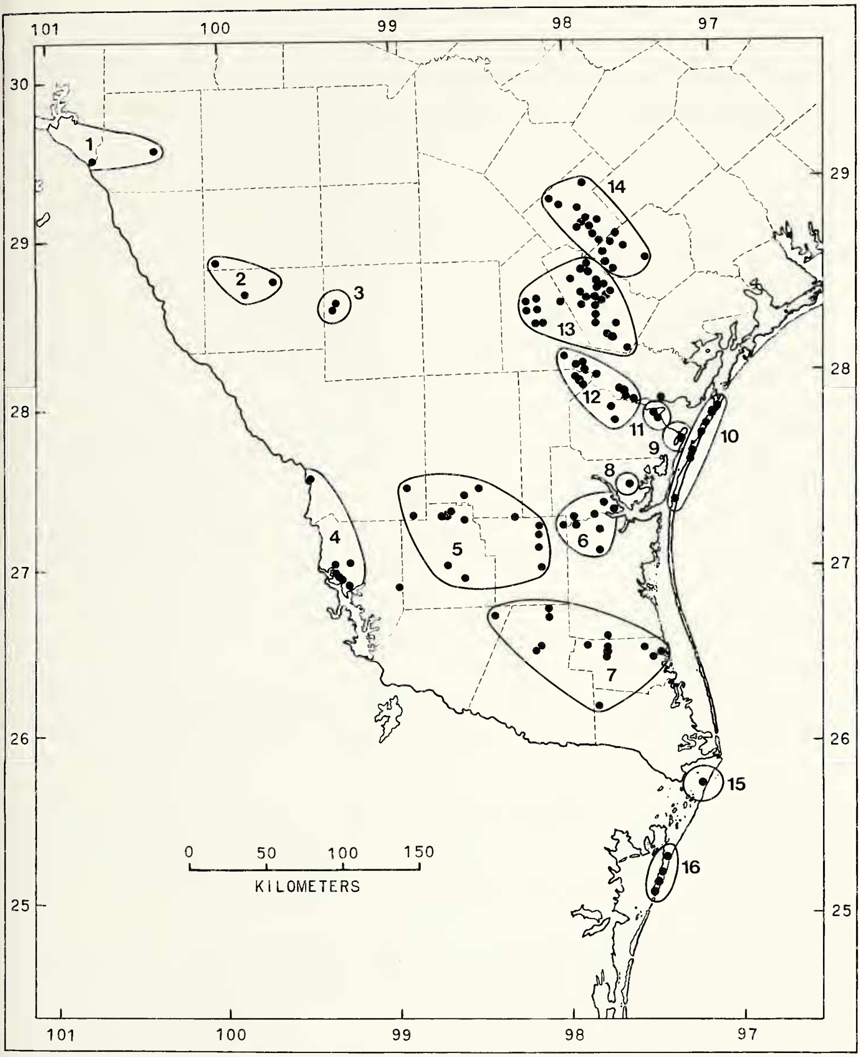

Fig. 1.—Approximate geographic areas included in the 16 samples of *Geomys personatus*. Dots represent collecting localities of specimens examined in this study. See text for localities included in each sample.

Kenedy, and Willacy cos.; *sample 8*—north of Baffin Bay in Kleberg Co.; *sample 9*—mainland of Nueces Co., east of Corpus Christi; *sample 10*—barrier islands (Mustang Island and Padre Island) of Kleberg and Nueces cos.; *sample 11*—immediate vicinity of Corpus Christi, Nueces Co.; *sample 12*—Jim Wells, southeastern Live Oak, western

Nueces, and San Patricio cos.; *sample 13*—Bee and Live Oak (northern two-thirds) cos.; *sample 14*—Goliad and Karnes cos.; *sample 15*—coastal beach of Tamaulipas, approximately 34 km of ESE Matamoros; *sample 16*—coastal beach of Tamaulipas, approxmately 88 km S Matamoros. Acronyms used in lists of specimens examined are given in the acknowledgments. The acronym for Carnegie Museum of Natural History used in text is CM.

Univariate analyses were performed using the program UNIVAR. This program generates standard statistics (mean, range, standard deviation, standard error of mean, variance, and coefficient of variation), and employs a single-classification analysis of variance (F-test, significance level 0.05) to test for significant differences between or among means (Sokal and Rohlf, 1969). When means were found to be significantly different, the Sum of Squares Simultaneous Test Procedure (SS-STP) developed by Gabrial (1964) was used to determine maximally nonsignificant subsets.

Cluster and principal components analyses were performed using the MINT program. Matrices of Q-mode correlation (among OTU's) and phenetic and distance coefficients were computed. Cluster analyses were conducted using UPGMA (unweighted pair-group method using arithmetic averages) on the correlation and distance matrices and a phenogram was generated for each. Phenograms were compared with their respective matrices, and a coefficient of cophenetic correlation was computed. The first three principal components were extracted and projections of the OTU's onto them were prepared.

Stepwise discriminant analysis and canonical analysis (BMDP7M, Dixon and Brown, 1977) are techniques that define and separate groups. The program performs a multiple discriminant analysis in a stepwise manner, selecting the variable entered by finding the variable with the greatest F value. The F value for inclusion was set at 0.01, and the F value for deletion was set at 0.05. Canonical coefficients were derived by multiplying the coefficients of each discriminant function by the mean of each corresponding variable. The program also classifies individuals, placing them with the group to which they are nearest on the discriminant functions.

Discriminant function analyses were performed using the BMD-04M subroutine of the Biomedical Computer Programs (Dixon, 1971). This program used variance-covariance mathematics to differentially weigh characters relative to their within-group and between-group variation. Two reference samples were used for discriminant analyses in this paper—one of *Geomys bursarius* and the second of *G. personatus*. These reference samples were used to generate discriminant multipliers for each character, and these were multiplied by the value of their respective characters; all such values were summed for each individual to yield its discriminant score. Discriminant scores were obtained for individuals of questioned identity using the multipliers generated by the reference samples, in order to properly identify the questioned individuals.

Specimens from Texas (30) used as a reference sample for *Geomys attwateri* (see Tucker and Schmidly, 1981, for use of *G. attwateri*) were as follows: ARANSAS Co., Aransas Refuge, 1 (TCWC); 10 mi SE Austwell, 2 (TCWC); Rockport, 3 (TNHC); 2 mi SW Rockport, 1 (TNHC); 8 mi SW Rockport, 2 (TCWC); ATASCOSA Co., 2 mi NW Campbellton, 2 (TCWC); 7 mi E Lytle, 5 (TNHC); 7 mi SE Lytle, 3 (TNHC); McCoy, 1 (TNHC); FRIO Co., 1 mi N Moore, 3 (TCWC); GOLIAD Co., 1½ mi SSE Berclaire, 1 (TNHC); 2 mi SSE Berclaire, 1 (TNHC); GONZALES Co., 1.5 mi S Leesville, 1 (TNHC); 5 mi SE Luling, 1 (TNHC); 11 mi S Luling, 1 (TNHC); GUADALUPE Co., 11 mi S Seguin, 1 (TNHC); VICTORIA Co., 6 mi S Victoria, 1 (TCWC).

Specimens (30, also in list of specimens examined for *G. p. fallax*) used as a reference sample for *Geomys personatus fallax* were from the following Texas localities: JIM WELLS Co., Sandia, 3; 1.8 mi S, 2.3 mi E Sandia, 1; LIVE OAK Co., 8 mi NW George West, 1; 5 mi NW George West, 1; 4 mi N George West, 2; 3 mi N George West, 3; 5 mi S Three Rivers, 1; NUECES Co., Calallen, 4; 1 mi E Calallen, 1; 17 mi W Corpus Christi, 5; SAN PATRICIO Co., 5 mi SE Edroy, 4; 3 mi SW Mathis, 2; ¼ mi SE Odem, 1; County unknown, 10 mi from mouth of Nueces River, 1.

RESULTS

Nongeographic Variation

The sample of *Geomys personatus* from Mustang Island, Nueces Co., Texas, was subjected to univariate analyses to determine the type and extent of nongeographic variation (age, secondary sexual, and individual) in the species.

Variation with age.—In males, all measurements studied, except interorbital constriction, were found to vary significantly with age; in females all measurements varied significantly with age (Table 1). In external measurements, adults and subadults of each sex formed a group that differed significantly from juveniles. In all cranial measurements (except interorbital constriction) all three age classes of males and females formed nonsignificant subsets. The interorbital constriction of females had a subset formed by juveniles and subadults that was significantly different from adults (there were no significant differences among age groups of males). In all measurements for both sexes, adults had the largest means, followed by subadults, and then by juveniles. Clearly the three age classes that we recognized are morphologically distinct. Only adult individuals are used in subsequent analyses.

Secondary sexual variation.—The same adult males and females used in analysis of variation with age were used to test for secondary sexual variation (Table 1). Males averaged significantly larger than females in all measurements except interorbital constriction, for which the mean was only slightly larger. In all analyses of geographic variation, males and females were treated separately.

Individual variation.—Coefficients of variation ranged from 3.5 to 9.5 for adult males and 2.7 to 7.5 for adult females, for the 16 external and cranial measurements tested (Table 1). The mean coefficient of variation for these measurements was 5.0 and 4.1 for males and females, respectively. In both sexes the coefficient of variation was usually higher for external measurements than for cranial measurements. The only exception was interorbital constriction of males, which had the highest value (9.5); the lowest value for males was in squamosal breadth (3.5). For cranial measurements of females, the diastema had the highest value (5.0) and condylobasal length had the lowest (2.7). Males had larger coefficients of variation than females for all measurements except length of tail and squamosal breadth.

Geographic Variation

Univariate analyses.—Eleven samples of males and 12 of females had a sufficient number (three or more) of specimens to allow their use in univariate analyses. Results of the analyses of variance and SS-STP for these samples are shown in Table 2.

Table 1.—*Variation with age in external and cranial measurements of* Geomys personatus *from the barrier beach of Kleberg and Nueces counties, Texas. Age classes were tested for significant differences at the 0.05 level. Group means that were found to be significantly different were tested with SS-STP to determine the maximally nonsignificant subsets. The adult samples as listed in this table were used to test for secondary sexual variation. Measurement names marked with an asterisk indicate those with significant (0.05) secondary sexual variation.*

Sex and age class	N	Mean (range) ± 2 SE	CV	SS-STP		
		*Total length**				
Males						
Adults	24	314.7 (264.0–360.0) ± 7.80	6.1	I		
Subadults	25	306.6 (260.0–332.0) ± 6.27	5.1	I		
Juveniles	7	257.6 (232.0–271.0) ± 10.06	5.2		I	
Females						
Adults	18	284.9 (263.0–312.0) ± 7.00	5.2	I		
Subadults	34	276.6 (247.0–312.0) ± 5.04	5.3	I		
Juveniles	9	238.2 (215.0–265.0) ± 11.53	7.3		I	
		*Length of tail**				
Males						
Adults	24	105.0 (91.0–123.0) ± 3.17	7.4	I		
Subadults	25	104.1 (78.0–121.0) ± 4.61	11.1	I		
Juveniles	7	87.4 (77.0–94.0) ± 4.40	6.7		I	
Females						
Adults	18	94.6 (80.0–106.0) ± 3.36	7.5	I		
Subadults	34	92.9 (71.0–112.0) ± 3.20	10.0	I		
Juveniles	9	80.3 (66.0–90.0) ± 5.12	9.6		I	
		*Length of hind foot**				
Males						
Adults	24	39.3 (33.0–43.0) ± 1.10	6.9	I		
Subadults	25	38.9 (33.0–42.0) ± 1.03	6.6	I		
Juveniles	7	36.2 (34.0–37.0) ± 0.88	3.2		I	
Females						
Adults	18	36.8 (32.0–39.0) ± 1.01	5.8	I		
Subadults	34	36.2 (32.0–40.0) ± 0.72	5.8	I		
Juveniles	9	33.1 (30.0–37.0) ± 1.73	7.8		I	
		*Greatest length of skull**				
Males						
Adults	23	58.2 (54.1–62.5) ± 0.94	3.9	I		
Subadults	25	55.3 (50.6–60.2) ± 0.93	4.2		I	
Juveniles	6	45.6 (43.8–47.8) ± 1.22	3.3			I
Females						
Adult	14	53.3 (51.2–55.3) ± 0.84	2.9	I		
Subadult	33	50.7 (47.5–55.5) ± 0.64	3.6		I	
Juveniles	9	43.4 (37.9–47.2) ± 2.30	8.0			I
		*Condylobasal length**				
Males						
Adults	26	57.2 (53.0–60.8) ± 0.82	3.7	I		

Table 1.—*Continued.*

Sex and age class	N	Mean (range) ± 2 SE	CV	SS-STP		
Subadults	27	54.4 (46.4–59.8) ± 1.06	5.1		I	
Juveniles	6	44.3 (42.2–46.3) ± 1.18	3.3			I
Females						
Adults	19	52.0 (50.1–54.5) ± 0.65	2.7	I		
Subadults	36	49.5 (46.4–54.4) ± 0.57	3.5		I	
Juveniles	9	42.5 (37.5–46.5) ± 2.25	7.9			I
		*Basal length**				
Males						
Adults	26	53.9 (50.2–57.4) ± 0.78	3.7	I		
Subadults	27	50.5 (43.4–56.0) ± 1.01	5.2		I	
Juveniles	6	40.7 (38.9–42.8) ± 1.23	3.7			I
Females						
Adults	19	48.6 (46.7–51.5) ± 0.65	2.9	I		
Subadults	36	46.0 (42.8–50.1) ± 0.56	3.7		I	
Juveniles	9	38.9 (33.7–42.9) ± 2.34	9.0			I
		*Palatal length**				
Males						
Adults	26	37.8 (34.9–40.2) ± 0.57	3.8	I		
Subadults	27	35.1 (30.0–39.3) ± 0.75	5.6		I	
Juveniles	7	27.3 (24.0–29.0) ± 1.34	6.5			I
Females						
Adults	19	33.6 (32.2–35.9) ± 0.52	3.4	I		
Subadults	38	31.7 (29.0–35.3) ± 0.47	4.5		I	
Juveniles	9	26.5 (22.6–29.7) ± 1.75	9.9			I
		*Palatofrontal depth**				
Males						
Adults	26	20.3 (19.0–22.2) ± 0.30	3.8	I		
Subadults	27	19.0 (16.9–21.1) ± 0.34	4.7		I	
Juveniles	7	15.6 (14.5–16.7) ± 0.57	4.9			I
Females						
Adults	19	18.6 (17.8–19.7) ± 0.26	3.0	I		
Subadults	38	17.5 (16.0–19.5) ± 0.26	4.5		I	
Juveniles	9	15.2 (13.2–16.9) ± 0.99	9.7			I
		*Length of nasals**				
Males						
Adults	23	20.7 (18.7–22.5) ± 0.42	4.9	I		
Subadults	26	19.0 (17.1–22.6) ± 0.44	5.9		I	
Juveniles	7	14.7 (12.7–16.0) ± 0.85	7.7			I
Females						
Adults	14	18.2 (17.3–19.5) ± 0.43	4.4	I		
Subadults	37	17.1 (15.5–18.9) ± 0.34	6.1		I	
Juveniles	9	14.0 (10.9–16.2) ± 1.24	13.1			I
		*Diastema**				
Males						
Adults	26	21.0 (19.1–22.8) ± 0.43	5.2	I		

Table 1.—*Continued.*

Sex and age class	N	Mean (range) ± 2 SE	CV	SS-STP		
Subadults	27	18.9 (15.1–22.1) ± 0.58	7.9		I	
Juveniles	7	14.1 (11.7–15.7) ± 1.02	9.5			I
Females						
Adults	19	18.1 (16.6–19.8) ± 0.41	5.0	I		
Subadults	38	16.8 (14.6–19.4) ± 0.34	6.2		I	
Juveniles	9	13.2 (10.4–15.0) ± 1.25	14.2			I
		*Zygomatic breadth**				
Males						
Adults	26	35.8 (32.9–38.0) ± 0.63	4.5	I		
Subadults	27	32.9 (28.2–36.5) ± 0.79	6.2		I	
Juveniles	7	25.3 (23.6–26.7) ± 0.91	4.8			I
Females						
Adults	18	31.4 (29.8–32.7) ± 0.45	3.0	I		
Subadults	36	29.6 (26.9–32.9) ± 0.47	4.8		I	
Juveniles	9	24.9 (20.4–28.5) ± 1.95	11.7			I
		*Mastoid breadth**				
Males						
Adults	26	32.7 (29.9–35.9) ± 0.51	4.0	I		
Subadults	27	30.5 (27.1–34.0) ± 0.61	5.2		I	
Juveniles	6	25.0 (23.3–26.3) ± 0.83	4.1			I
Females						
Adults	19	29.4 (27.4–31.1) ± 0.53	3.9	I		
Subadults	38	27.9 (25.6–31.3) ± 0.41	4.5		I	
Juveniles	9	24.1 (20.7–26.5) ± 1.41	8.8			I
		*Squamosal breadth**				
Males						
Adults	26	23.9 (22.4–26.0) ± 0.33	3.5	I		
Subadults	27	22.6 (20.3–24.7) ± 0.39	4.5		I	
Juveniles	6	19.7 (18.8–20.2) ± 0.40	2.5			I
Females						
Adults	19	22.4 (21.0–23.6) ± 0.40	3.9	I		
Subadults	38	21.2 (19.4–23.2) ± 0.27	3.8		I	
Juveniles	9	19.4 (18.0–20.6) ± 0.68	5.3			I
		*Rostral breadth**				
Males						
Adults	25	12.8 (11.4–13.9) ± 0.24	4.6	I		
Subadults	27	12.1 (9.3–13.3) ± 0.29	6.3		I	
Juveniles	7	9.7 (8.7–10.9) ± 0.62	8.5			I
Females						
Adults	19	11.6 (10.6–12.2) ± 0.22	4.1	I		
Subadults	38	10.9 (10.2–11.8) ± 0.14	4.0		I	
Juveniles	9	9.8 (8.2–11.0) ± 0.57	8.7			I

Table 1.—*Continued.*

Sex and age class	N	Mean (range) ± 2 SE	CV	SS-STP		
		Interorbital constriction				
Males						
Adults	25	7.4 (6.1–9.6) ± 0.28	9.5	ns		
Subadults	27	7.1 (6.3–8.1) ± 0.15	5.5			
Juveniles	7	6.8 (6.1–7.3) ± 0.33	6.3			
Females						
Adults	19	7.2 (6.6–7.7) ± 0.13	3.8	I		
Subadults	38	7.0 (6.3–8.0) ± 0.11	4.8		I	
Juveniles	9	6.9 (6.5–7.3) ± 0.17	3.7		I	
		*Breadth across maxillaries**				
Males						
Adults	26	9.9 (9.1–10.7) ± 0.15	3.8	I		
Subadults	27	9.4 (7.6–10.1) ± 0.19	5.3		I	
Juveniles	7	8.3 (7.9–8.7) ± 0.19	3.1			I
Females						
Adults	19	9.5 (8.9–10.1) ± 0.15	3.4	I		
Subadults	38	9.1 (8.4–9.8) ± 0.10	3.5		I	
Juveniles	9	8.5 (7.8–9.1) ± 0.29	5.1			I

In all measurements of males, sample 10 had the largest mean. For 12 measurements, samples 8 and 9 had the second and third largest means. In the remaining measurements the means of these samples ranked third and fourth (two measurements), third and fifth, and second and fifth. For eight measurements, the fourth to seventh positions were taken by samples 5, 6, 7, and 16; in seven measurements, three of four of these positions were taken by these samples. The eighth, ninth, and tenth positions of ranked means were typically taken by samples 4, 12, and 13. For 11 measurements, each position was taken by the three samples; for the remaining five measurements, two of the three positions were taken by these samples. Sample 2 had the smallest means and ranked eleventh for all measurements.

A similar pattern of ranking was observed in females. Sample 10 ranked the largest in all measurements, except for two external measurements where the mean of this sample ranked second largest. Samples 8 and 9 fell into the second and third positions for 13 measurements. In the remaining measurements, these two samples ranked first and fourth, first and fifth, and second and fourth. For 11 measurements, means of samples 5, 6, 7, and 16 fell into the fourth to seventh ranked positions; for three measurements, three of the four positions were filled by these samples. Samples 4, 12, 13, and 14 filled the eighth to eleventh positions in 13 measurements; two measurements had three

Table 2.—*Geographic variation in external and cranial measurements of* Geomys personatus. *Samples are defined in text and were tested for significant differences at the 0.05 level. Sample means that were found to be significantly different were tested with SS-STP to determine the maximally nonsignificant subsets. Samples with fewer than three individuals are omitted from this table.*

Sex and locality number	N	Mean (range) ± 2 SE	CV	Results of SS-STP					
		Total length							
Males									
10	35	315.3 (264.0–360.0) ± 5.83	5.5	I					
8	5	303.8 (294.0–322.0) ± 9.77	3.6	I	I				
9	4	299.3 (282.0–310.0) ± 13.50	4.5	I	I	I			
6	3	295.7 (289.0–307.0) ± 11.39	3.3	I	I	I	I		
7	8	291.0 (272.0–303.0) ± 8.99	4.4		I	I	I		
5	21	288.7 (269.0–310.0) ± 5.25	4.2		I	I	I		
16	10	279.8 (264.0–306.0) ± 8.78	5.0		I	I	I	I	
4	11	275.0 (248.0–314.0) ± 10.81	6.5			I	I	I	I
13	11	271.5 (242.0–304.0) ± 9.62	5.9				I	I	I
12	15	268.3 (247.0–290.0) ± 5.38	3.9					I	I
2	10	249.9 (226.0–280.0) ± 9.52	6.0						I
Females									
10	29	286.9 (263.0–312.0) ± 4.88	4.6	I					
8	3	285.0 (280.0–293.0) ± 8.08	2.5	I	I				
9	9	265.7 (242.0–284.0) ± 9.31	5.6		I	I			
16	15	259.9 (234.0–278.0) ± 6.72	5.0		I	I	I		
5	17	257.9 (240.0–274.0) ± 4.89	3.9		I	I	I		
7	14	257.1 (238.0–280.0) ± 5.83	4.3		I	I	I	I	
6	5	254.0 (223.0–278.0) ± 20.97	9.2		I	I	I	I	
14	8	253.6 (237.0–274.0) ± 7.62	4.3		I	I	I	I	
4	13	252.9 (229.0–269.0) ± 6.83	4.9			I	I	I	
13	9	241.3 (228.0–252.0) ± 5.66	3.5				I	I	I
12	12	239.7 (220.0–270.0) ± 7.61	5.5					I	I
2	15	225.7 (216.0–234.0) ± 3.06	2.6						I
		Length of tail							
Males									
10	35	105.0 (86.0–125.0) ± 2.89	8.1	I					
8	5	101.8 (93.0–110.0) ± 6.05	6.6	I	I				
9	4	96.5 (92.0–100.0) ± 3.42	3.5	I	I	I			
16	10	91.8 (65.0–106.0) ± 7.37	12.7	I	I	I	I		
6	3	90.0 (81.0–97.0) ± 9.45	9.1		I	I	I		
7	8	89.5 (80.0–108.0) ± 7.48	11.8		I	I	I		
4	11	88.4 (62.0–105.0) ± 6.38	11.9		I	I	I		
5	21	87.5 (69.0–103.0) ± 3.81	10.0		I	I	I		
12	15	83.9 (65.0–97.0) ± 4.17	9.6		I	I	I		
13	11	81.4 (59.0–94.0) ± 6.26	12.8			I	I		
2	10	79.1 (64.0–96.0) ± 5.55	11.1				I		
Females									
8	3	95.7 (94.0–97.0) ± 1.76	1.6	I					
10	29	95.7 (80.0–110.0) ± 2.49	7.0	I					

Table 2.—*Continued.*

Sex and locality number	N	Mean (range) ± 2 SE			CV	Results of SS-STP				
16	14	86.9	(76.0–96.0)	± 3.17	6.8	I	I			
9	9	83.8	(74.0–99.0)	± 6.49	11.6		I	I		
7	14	83.6	(70.0–93.0)	± 3.67	8.2		I	I		
4	13	80.0	(68.0–89.0)	± 4.04	9.1		I	I	I	
14	8	79.1	(74.0–87.0)	± 3.01	5.4		I	I	I	
13	9	76.7	(66.0–89.0)	± 4.65	9.1		I	I	I	
5	17	76.1	(59.0–88.0)	± 4.01	10.9			I	I	
12	12	75.8	(60.0–81.0)	± 3.59	8.2			I	I	
6	5	75.2	(63.0–87.0)	± 9.52	14.1			I	I	
2	15	70.1	(62.0–80.0)	± 2.60	7.2				I	
		Length of hind foot								
Males										
10	35	39.5	(33.0–43.0)	± 0.84	6.3	I				
9	4	38.5	(36.0–41.0)	± 2.38	6.2	I	I			
8	5	37.9	(36.2–40.5)	± 1.48	4.4	I	I			
5	21	36.5	(32.8–40.0)	± 0.78	4.9		I	I		
16	10	36.4	(35.0–39.0)	± 0.80	3.5		I	I		
7	8	36.3	(34.0–38.0)	± 0.95	3.7		I	I		
6	3	36.0	(35.0–37.0)	± 1.15	2.8		I	I	I	
4	11	35.5	(31.4–38.0)	± 1.12	5.2		I	I	I	
13	10	33.4	(30.0–36.0)	± 1.05	5.0			I	I	I
12	15	33.0	(28.0–35.0)	± 0.89	5.3				I	I
2	10	30.8	(27.0–34.4)	± 1.61	8.3					I
Females										
8	3	36.9	(35.7–38.6)	± 1.73	4.1	I				
10	29	36.7	(32.0–39.0)	± 0.70	5.1	I				
7	14	33.9	(32.0–35.4)	± 0.57	3.2		I			
5	17	33.5	(31.0–35.0)	± 0.64	3.9		I			
9	9	33.2	(30.0–36.0)	± 1.45	6.5		I	I		
4	13	33.1	(31.0–35.0)	± 0.86	4.7		I	I		
16	15	33.0	(29.0–36.0)	± 0.96	5.6		I	I		
6	5	32.8	(30.0–38.0)	± 2.96	10.1		I	I	I	
14	8	32.1	(31.0–32.8)	± 0.43	1.9		I	I	I	
12	12	30.5	(26.0–35.0)	± 1.40	8.0			I	I	I
13	9	30.0	(27.5–32.6)	± 1.18	5.9				I	I
2	15	27.7	(24.0–30.0)	± 1.08	7.6					I
		Greatest length of skull								
Males										
10	32	57.9	(54.1–62.5)	± 0.72	3.5	I				
9	4	55.3	(53.2–58.4)	± 2.25	4.1	I	I			
8	5	54.7	(52.0–56.6)	± 1.69	3.5	I	I	I		
6	4	52.9	(51.3–53.9)	± 1.16	2.2		I	I	I	
7	8	52.9	(50.7–54.8)	± 1.05	2.8		I	I	I	
5	21	51.7	(48.7–56.1)	± 0.80	3.5		I	I	I	I
16	10	51.6	(48.4–54.2)	± 1.21	3.7			I	I	I
13	15	50.7	(46.8–55.7)	± 1.13	4.3				I	I

Table 2.—*Continued.*

Sex and locality number	N	Mean (range) ± 2 SE	CV	Results of SS-STP							
4	11	49.9 (47.1–55.4) ± 1.57	5.2				I	I			
12	15	49.8 (47.5–52.5) ± 0.64	2.5					I			
2	9	45.1 (42.5–48.4) ± 1.46	4.8						I		
Females											
10	24	52.9 (50.2–55.3) ± 0.59	2.7	I							
8	3	51.2 (49.2–52.7) ± 2.08	3.5	I	I						
9	11	49.5 (46.4–52.3) ± 1.16	3.9		I	I					
6	8	48.5 (46.1–51.8) ± 1.27	3.7		I	I	I				
7	10	46.9 (44.5–48.8) ± 0.99	3.3			I	I	I			
16	13	46.9 (45.7–48.5) ± 0.54	2.1				I	I			
5	18	46.3 (44.3–48.1) ± 0.69	3.1				I	I	I		
14	8	45.0 (43.6–46.5) ± 0.79	2.5					I	I	I	
4	13	44.1 (41.9–46.4) ± 0.71	2.9						I	I	
12	12	43.9 (41.2–46.2) ± 0.89	3.5							I	
13	11	43.3 (41.0–45.8) ± 0.87	3.3							I	
2	13	40.0 (37.8–42.3) ± 0.79	3.6								I
		Condylobasal length									
Males											
10	37	56.8 (53.0–60.8) ± 0.66	3.5	I							
9	4	53.8 (52.1–56.4) ± 1.91	3.5	I	I						
8	5	53.4 (51.2–55.4) ± 1.72	3.6		I	I					
6	4	51.6 (50.0–52.6) ± 1.13	2.2		I	I	I				
7	8	51.5 (49.4–53.2) ± 1.15	3.2		I	I	I				
5	23	50.7 (48.0–55.1) ± 0.80	3.8		I	I	I	I			
16	10	50.3 (47.0–52.4) ± 1.02	3.2		I	I	I	I			
13	16	49.7 (45.3–55.1) ± 1.15	4.6			I	I	I			
12	15	48.9 (46.0–51.5) ± 0.70	2.8				I	I			
4	11	48.4 (46.1–54.2) ± 1.51	5.2					I			
2	10	43.7 (39.5–48.2) ± 1.66	6.0						I		
Females											
10	30	51.7 (49.0–54.5) ± 0.50	2.7	I							
8	3	49.7 (47.8–51.2) ± 2.02	3.5	I	I						
9	11	48.4 (45.6–50.8) ± 1.02	3.5		I						
6	8	47.3 (45.1–50.5) ± 1.18	3.5		I	I					
16	17	45.5 (43.7–47.4) ± 0.49	2.2			I	I				
7	15	45.4 (43.2–47.9) ± 0.72	3.1			I	I				
5	18	45.3 (43.3–46.9) ± 0.58	2.7			I	I	I			
14	8	44.2 (42.9–45.7) ± 0.75	2.4				I	I	I		
12	13	43.2 (40.3–45.5) ± 0.85	3.5					I	I		
4	13	42.9 (40.5–45.0) ± 0.73	3.1						I		
13	13	42.7 (39.7–45.0) ± 0.87	3.7						I		
2	16	39.2 (36.8–41.4) ± 0.65	3.3							I	
		Basal length									
Males											
10	37	53.6 (50.2–57.4) ± 0.62	3.5	I							
9	4	51.1 (49.6–53.5) ± 1.83	3.6	I	I						

Table 2.—*Continued.*

Sex and locality number	N	Mean (range) ± 2 SE	CV	Results of SS-STP							
8	5	50.6 (48.4–52.7) ± 1.76	3.9	I	I	I					
7	8	48.8 (46.0–50.7) ± 1.25	3.6		I	I	I				
6	4	48.8 (47.2–49.7) ± 1.12	2.3		I	I	I	I			
5	23	47.9 (44.6–52.3) ± 0.82	4.1		I	I	I	I			
16	10	47.7 (44.7–50.0) ± 1.01	3.3		I	I	I	I			
13	16	46.8 (42.5–51.8) ± 1.10	4.7			I	I	I			
12	15	46.6 (43.2–49.9) ± 0.82	3.4				I	I			
4	11	45.6 (43.0–51.5) ± 1.58	5.7					I			
2	10	41.4 (37.1–45.7) ± 1.63	6.2						I		
Females											
10	30	48.2 (41.9–51.5) ± 0.65	3.7	I							
8	3	46.8 (45.2–48.3) ± 1.80	3.3	I	I						
9	10	45.5 (42.6–48.1) ± 1.07	3.7		I	I					
6	8	44.6 (42.4–47.6) ± 1.13	3.6		I	I	I				
16	17	42.9 (41.6–44.7) ± 0.45	2.2			I	I				
5	18	42.7 (40.6–44.6) ± 0.61	3.0				I	I			
7	15	42.7 (40.4–45.5) ± 0.71	3.2				I	I			
14	10	41.7 (40.3–43.1) ± 0.67	2.5				I	I	I		
12	12	40.6 (37.7–43.0) ± 0.95	4.0					I	I		
13	14	40.1 (37.6–42.7) ± 0.78	3.7						I		
4	13	40.1 (37.5–41.8) ± 0.73	3.3						I		
2	16	36.9 (34.8–38.7) ± 0.64	3.5							I	
Palatal length											
Males											
10	37	37.6 (34.9–40.2) ± 0.47	3.8	I							
9	4	36.1 (34.9–37.8) ± 1.36	3.8	I	I						
8	5	35.5 (34.0–37.3) ± 1.36	4.3	I	I	I					
6	4	34.1 (33.6–35.1) ± 0.69	2.0		I	I	I				
7	8	33.8 (31.7–35.1) ± 0.86	3.6		I	I	I				
5	23	33.4 (31.0–36.4) ± 0.65	4.6		I	I	I				
13	16	32.6 (28.7–36.7) ± 0.96	5.9			I	I				
16	10	32.6 (30.2–34.4) ± 0.76	3.7			I	I				
12	15	32.2 (29.1–34.4) ± 0.66	3.9				I				
4	11	32.0 (30.5–35.7) ± 1.00	5.2				I				
2	10	28.6 (25.6–32.2) ± 1.26	7.0					I			
Females											
10	30	33.5 (32.2–35.9) ± 0.37	3.0	I							
8	3	32.2 (31.1–33.0) ± 1.16	3.1	I	I						
9	11	31.6 (29.9–33.6) ± 0.73	3.9		I						
6	8	30.9 (29.1–32.9) ± 0.83	3.8		I	I					
5	19	29.5 (28.1–32.9) ± 0.54	4.0			I	I				
7	15	29.5 (27.7–31.7) ± 0.53	3.5			I	I	I			
16	17	29.1 (27.0–30.6) ± 0.45	3.2			I	I	I	I		
14	10	28.7 (27.1–29.8) ± 0.57	3.1				I	I	I	I	
12	13	27.9 (25.6–29.7) ± 0.66	4.3					I	I	I	
4	13	27.6 (25.6–28.8) ± 0.54	3.5						I	I	
13	14	27.4 (25.8–29.4) ± 0.63	4.3							I	
2	16	25.1 (23.4–26.7) ± 0.46	3.7								I

Table 2.—*Continued.*

Sex and locality number	N	Mean (range) ± 2 SE	CV	Results of SS-STP							
		Palatofrontal depth									
Males											
10	37	20.2 (18.5–22.2) ± 0.24	3.6	I							
9	4	19.9 (18.7–20.8) ± 1.01	5.1	I	I						
8	5	19.4 (18.8–20.7) ± 0.70	4.0	I	I						
7	8	19.2 (17.8–20.6) ± 0.73	5.4	I	I	I					
6	4	18.9 (17.6–19.6) ± 0.89	4.7		I	I	I				
5	23	18.5 (17.1–20.0) ± 0.29	3.7		I	I	I				
16	10	18.4 (17.0–19.3) ± 0.50	4.3		I	I	I				
13	16	17.9 (16.6–19.7) ± 0.36	4.0			I	I				
12	15	17.8 (17.1–18.5) ± 0.19	2.1				I				
4	11	17.7 (16.6–20.3) ± 0.60	5.7				I				
2	10	15.9 (14.5–17.4) ± 0.59	5.9					I			
Females											
10	31	18.5 (17.6–19.7) ± 0.19	2.9	I							
8	3	18.4 (17.6–19.1) ± 0.87	4.1	I	I						
9	11	17.9 (17.1–18.9) ± 0.35	3.2	I	I	I					
6	8	17.5 (16.7–18.1) ± 0.33	2.7		I	I	I				
5	19	17.2 (16.4–19.1) ± 0.29	3.6		I	I	I				
7	15	17.1 (15.7–18.3) ± 0.33	3.7			I	I	I			
16	17	17.0 (16.1–18.0) ± 0.23	2.8				I	I	I		
14	10	16.5 (15.6–17.3) ± 0.30	2.9				I	I	I	I	
4	13	16.4 (15.4–17.2) ± 0.36	3.9					I	I	I	
12	13	16.2 (15.4–17.2) ± 0.24	2.6						I	I	
13	15	15.7 (15.1–16.9) ± 0.25	3.1							I	
2	16	14.6 (14.1–15.4) ± 0.22	3.0								I
		Length of nasals									
Males											
10	32	20.9 (18.7–22.5) ± 0.35	4.8	I							
9	4	20.2 (19.1–21.9) ± 1.34	6.6	I	I						
8	5	19.7 (18.2–21.4) ± 1.14	6.4	I	I	I					
7	8	19.0 (17.9–20.4) ± 0.59	4.4		I	I	I				
5	21	18.8 (17.0–20.2) ± 0.39	4.8		I	I	I				
6	4	18.6 (17.6–20.3) ± 1.16	6.3		I	I	I				
13	14	18.3 (16.3–20.3) ± 0.67	6.9		I	I	I				
12	15	17.9 (16.7–19.1) ± 0.39	4.2			I	I				
16	10	17.8 (16.7–18.9) ± 0.42	3.7				I				
4	11	17.8 (15.9–19.4) ± 0.68	6.4				I	I			
2	9	15.9 (14.7–18.0) ± 0.65	6.1					I			
Females											
10	24	18.4 (17.3–19.5) ± 0.29	3.9	I							
9	11	17.7 (16.5–19.1) ± 0.56	5.2	I	I						
8	3	17.4 (17.1–17.7) ± 0.35	1.7	I	I	I					
6	8	16.7 (15.6–18.4) ± 0.71	6.0		I	I					
7	10	16.3 (14.5–17.9) ± 0.59	5.7		I	I	I				
5	19	16.3 (15.1–18.8) ± 0.44	5.9			I	I				

Table 2.—*Continued.*

Sex and locality number	N	Mean (range) ± 2 SE	CV	Results of SS-STP						
16	13	15.7 (14.5–16.5) ± 0.45	5.2			I	I	I		
14	8	15.7 (14.9–16.8) ± 0.47	4.2			I	I	I		
12	12	15.1 (13.8–16.2) ± 0.41	4.7				I	I		
4	13	14.9 (14.2–16.3) ± 0.38	4.6					I		
13	11	14.7 (13.9–15.7) ± 0.37	4.2					I	I	
2	13	13.3 (12.0–14.6) ± 0.44	6.0						I	
		Diastema								
Males										
10	37	20.8 (18.7–22.8) ± 0.36	5.3	I						
9	4	19.7 (19.2–20.4) ± 0.55	2.8	I	I					
8	5	19.7 (19.0–20.7) ± 0.58	3.3	I	I	I				
6	4	19.1 (18.5–19.6) ± 0.53	2.8	I	I	I				
7	8	18.7 (17.2–19.8) ± 0.71	5.4		I	I				
5	23	18.7 (17.4–21.5) ± 0.46	5.9		I	I				
13	16	18.4 (15.7–21.6) ± 0.65	7.1		I	I				
12	15	18.2 (16.4–19.6) ± 0.48	5.1		I	I				
16	10	18.1 (16.4–19.3) ± 0.57	5.0		I	I				
4	11	17.6 (16.5–20.6) ± 0.83	7.8			I	I			
2	10	15.7 (13.8–17.9) ± 0.79	8.0				I			
Females										
10	31	18.0 (16.3–19.8) ± 0.31	4.8	I						
8	3	17.4 (17.1–17.9) ± 0.48	2.4	I	I					
9	11	17.2 (16.3–18.9) ± 0.50	4.8	I	I	I				
6	8	16.6 (15.1–18.3) ± 0.70	5.9		I	I	I			
5	19	16.0 (14.7–17.8) ± 0.33	4.5			I	I	I		
16	17	15.6 (14.3–16.9) ± 0.35	4.6				I	I	I	
7	15	15.6 (14.5–17.0) ± 0.44	5.5				I	I	I	
14	10	15.4 (14.5–17.0) ± 0.53	5.4				I	I	I	
12	13	15.2 (13.8–16.4) ± 0.47	5.5				I	I	I	
13	15	14.9 (13.6–16.8) ± 0.45	5.9					I	I	
4	13	14.6 (13.5–15.2) ± 0.26	3.2						I	I
2	16	13.3 (12.4–14.4) ± 0.32	4.8							I
		Zygomatic breadth								
Males										
10	37	35.5 (32.3–38.0) ± 0.54	4.6	I						
9	4	33.7 (32.0–35.2) ± 1.61	4.8	I	I					
8	5	33.4 (30.8–36.0) ± 1.79	6.0	I	I	I				
6	4	33.1 (30.5–34.6) ± 1.87	5.7	I	I	I	I			
7	8	32.4 (30.1–35.2) ± 1.30	5.7		I	I	I			
16	10	32.2 (29.9–34.1) ± 0.93	4.6		I	I	I			
5	23	31.7 (28.7–35.5) ± 0.73	5.5		I	I	I			
13	15	31.5 (29.5–33.8) ± 0.64	3.9		I	I	I			
12	15	30.9 (28.2–32.4) ± 0.55	3.5			I	I			
4	10	30.3 (28.3–33.9) ± 0.97	5.1				I			
2	10	27.0 (24.5–30.2) ± 1.19	7.0					I		

Table 2.—*Continued.*

Sex and locality number	N	Mean (range) ± 2 SE	CV	Results of SS-STP						
Females										
10	30	31.4 (29.5–33.6) ± 0.35	3.0	I						
8	3	30.6 (29.7–31.7) ± 1.16	3.3	I						
9	11	30.1 (28.4–32.8) ± 0.72	4.0	I	I					
16	16	28.4 (27.2–29.9) ± 0.37	2.6		I	I				
6	8	28.2 (26.4–30.7) ± 0.94	4.7			I				
7	15	27.9 (26.3–29.5) ± 0.45	3.1			I	I			
5	18	27.9 (26.7–28.9) ± 0.32	2.4			I	I			
14	9	27.1 (26.2–28.2) ± 0.39	2.2			I	I	I		
12	13	26.7 (24.8–28.5) ± 0.62	4.2				I	I		
4	13	26.4 (24.0–28.5) ± 0.70	4.8					I		
13	13	25.9 (24.1–27.5) ± 0.56	3.9					I		
2	15	23.9 (23.0–24.5) ± 0.22	1.7						I	
		Mastoid breadth								
Males										
10	37	32.6 (29.4–35.9) ± 0.44	4.1	I						
6	4	31.5 (29.9–32.4) ± 1.11	3.5	I	I					
8	5	31.2 (29.8–32.1) ± 0.78	2.8	I	I	I				
9	4	31.1 (28.5–32.7) ± 1.79	5.8	I	I	I	I			
7	8	30.5 (28.1–32.7) ± 1.05	4.9		I	I	I	I		
5	23	29.7 (26.9–32.9) ± 0.58	4.7		I	I	I	I		
16	10	29.5 (28.4–31.3) ± 0.64	3.4		I	I	I	I		
13	16	29.1 (27.5–32.0) ± 0.51	3.5			I	I	I		
4	11	28.6 (26.8–31.0) ± 0.78	4.5				I	I		
12	15	28.6 (27.2–30.6) ± 0.50	3.4					I		
2	10	25.2 (23.0–28.1) ± 0.96	6.0						I	
Females										
10	31	29.4 (27.4–31.3) ± 0.39	3.7	I						
8	3	28.9 (27.6–29.9) ± 1.36	4.1	I	I					
9	11	28.2 (27.3–30.5) ± 0.52	3.1	I	I					
6	8	27.8 (25.9–29.2) ± 0.70	3.6		I	I				
7	15	26.8 (25.4–28.2) ± 0.48	3.4		I	I	I			
5	18	26.5 (25.5–30.0) ± 0.49	3.9			I	I	I		
16	17	26.3 (25.0–28.0) ± 0.43	3.3			I	I	I		
14	10	26.2 (25.5–27.4) ± 0.44	2.7			I	I	I	I	
12	13	25.4 (23.7–27.0) ± 0.44	3.1				I	I	I	
4	13	25.2 (22.5–27.3) ± 0.77	5.5					I	I	
13	15	24.9 (23.3–26.3) ± 0.53	4.1						I	
2	16	22.8 (21.5–24.1) ± 0.44	3.9							I
		Squamosal breadth								
Males										
10	37	23.8 (22.3–26.0) ± 0.26	3.3	I						
6	4	23.3 (22.1–25.1) ± 1.28	5.5	I	I					
9	4	23.1 (21.4–24.1) ± 1.16	5.0	I	I					

Table 2.—*Continued.*

Sex and locality number	N	Mean (range) ± 2 SE	CV	Results of SS-STP					
7	8	23.0 (21.6–24.6) ± 0.84	5.2	I	I	I			
8	5	22.8 (22.3–23.4) ± 0.40	2.0	I	I	I	I		
5	23	22.4 (20.5–24.4) ± 0.44	4.7		I	I	I		
16	10	22.3 (21.2–23.5) ± 0.44	3.1		I	I	I		
13	16	22.0 (20.4–24.2) ± 0.45	4.1		I	I	I		
12	15	21.6 (20.1–24.0) ± 0.52	4.6			I	I		
4	11	21.4 (20.6–23.0) ± 0.47	3.7				I		
2	10	19.3 (17.7–21.2) ± 0.70	5.7					I	
Females									
10	31	22.4 (21.0–23.6) ± 0.29	3.6	I					
8	3	21.7 (20.9–22.2) ± 0.79	3.1	I	I				
6	8	21.5 (20.5–22.0) ± 0.35	2.3	I	I				
9	11	21.4 (20.4–23.2) ± 0.51	3.9		I				
7	15	21.1 (19.7–22.1) ± 0.41	3.8		I	I			
16	17	21.0 (20.0–22.4) ± 0.34	3.3		I	I			
5	19	20.8 (19.6–23.4) ± 0.40	4.2		I	I	I		
14	10	20.3 (19.6–21.2) ± 0.33	2.6		I	I	I	I	
12	13	20.0 (19.3–20.9) ± 0.26	2.4			I	I	I	
4	13	19.9 (18.2–21.7) ± 0.63	5.7				I	I	
13	15	19.4 (17.8–20.6) ± 0.44	4.3					I	I
2	16	18.2 (17.4–19.0) ± 0.24	2.7						I
		Rostral breadth							
Males									
10	36	12.8 (11.0–14.3) ± 0.23	5.4	I					
8	5	12.1 (11.5–12.6) ± 0.37	3.4	I	I				
9	4	12.1 (11.7–12.7) ± 0.43	3.6	I	I	I			
6	4	12.1 (11.4–12.7) ± 0.53	4.4	I	I	I			
7	8	11.5 (10.8–12.3) ± 0.42	5.1		I	I	I		
16	10	11.4 (10.9–11.9) ± 0.25	3.4		I	I	I		
5	23	11.2 (10.1–12.5) ± 0.23	4.9			I	I	I	
13	16	10.7 (10.1–11.4) ± 0.17	3.2				I	I	I
4	11	10.6 (9.8–11.5) ± 0.34	5.4					I	I
12	15	10.4 (10.0–10.9) ± 0.13	2.4						I
2	10	9.9 (9.3–10.6) ± 0.27	4.2						I
Females									
10	31	11.6 (10.6–12.4) ± 0.17	4.0	I					
8	3	11.5 (10.9–12.2) ± 0.75	5.6	I					
9	11	11.0 (10.4–12.0) ± 0.26	3.9	I	I				
16	17	10.4 (10.1–11.0) ± 0.13	2.6		I	I			
6	8	10.3 (9.9–10.6) ± 0.19	2.6		I	I			
7	15	10.1 (9.5–11.0) ± 0.27	5.1			I	I		
5	19	10.0 (9.5–10.9) ± 0.18	3.9			I	I	I	
14	10	9.8 (9.3–10.2) ± 0.17	2.8			I	I	I	I
4	13	9.5 (8.8–10.1) ± 0.21	3.9				I	I	I

Table 2.—*Continued.*

Sex and locality number	N	Mean	(range)	± 2 SE	CV	Results of SS-STP						
13	15	9.5	(8.7–10.6)	± 0.24	4.9					I	I	I
12	13	9.4	(8.7–10.2)	± 0.23	4.4						I	I
2	16	8.9	(8.2–9.3)	± 0.17	3.7							I
			Interorbital constriction									
Males												
10	35	7.1	(6.1–7.9)	± 0.16	6.8	I						
7	8	7.1	(6.7–7.8)	± 0.26	5.2	I						
8	5	7.0	(6.4–7.7)	± 0.48	7.6	I	I					
9	4	6.9	(6.7–7.1)	± 0.17	2.5	I	I	I				
4	11	6.9	(6.0–7.5)	± 0.26	6.4	I	I	I				
5	23	6.8	(6.1–7.3)	± 0.13	4.7	I	I	I				
16	10	6.7	(6.3–7.2)	± 0.18	4.3	I	I	I	I			
12	14	6.4	(5.9–6.7)	± 0.17	5.0		I	I	I			
6	4	6.3	(6.2–6.6)	± 0.17	2.7			I	I			
13	16	6.3	(5.8–6.7)	± 0.12	3.8				I			
2	10	6.3	(5.8–6.9)	± 0.20	5.1				I			
Females												
10	31	7.1	(6.5–7.7)	± 0.11	4.3	I						
9	11	6.9	(6.3–7.2)	± 0.18	4.4	I	I					
8	3	6.8	(6.4–7.3)	± 0.55	7.0	I	I					
4	13	6.7	(5.9–7.4)	± 0.24	6.5	I	I					
16	17	6.7	(6.2–7.3)	± 0.14	4.5		I					
5	18	6.7	(5.8–7.1)	± 0.16	5.0		I	I				
7	15	6.6	(6.1–7.2)	± 0.17	5.1		I	I				
14	10	6.6	(6.2–7.0)	± 0.17	4.0		I	I				
6	8	6.6	(5.9–7.1)	± 0.26	5.7		I	I	I			
12	13	6.4	(6.1–6.7)	± 0.11	3.2		I	I	I			
13	15	6.3	(6.0–6.7)	± 0.13	3.9			I	I			
2	16	6.1	(5.8–6.3)	± 0.09	2.8				I			
			Breadth across maxillaries									
Males												
10	37	9.9	(9.1–10.7)	± 0.15	4.5	I						
9	4	9.8	(9.1–10.8)	± 0.72	7.4	I	I					
7	8	9.6	(9.0–10.1)	± 0.23	3.3	I	I					
6	4	9.6	(9.0–10.2)	± 0.49	5.1	I	I	I				
8	5	9.5	(9.3–9.8)	± 0.20	2.4	I	I	I				
16	10	9.3	(8.8–9.6)	± 0.16	2.7		I	I				
5	23	9.3	(8.9–10.0)	± 0.12	3.2		I	I				
4	11	8.9	(8.5–9.3)	± 0.18	3.4			I	I			
13	16	8.8	(8.4–9.3)	± 0.12	2.7				I	I		
12	15	8.6	(8.1–9.3)	± 0.16	3.5				I	I		
2	10	8.2	(7.8–8.9)	± 0.25	4.8					I		
Females												
10	31	9.6	(8.9–10.4)	± 0.12	3.3	I						
8	3	9.6	(9.4–9.8)	± 0.24	2.2	I	I					

Table 2.—*Continued.*

Sex and locality number	N	Mean (range) ± 2 SE			CV	Results of SS-STP						
9	11	9.2	(8.6–9.6)	± 0.20	3.7	I	I	I				
6	8	9.2	(8.7–9.9)	± 0.26	3.9		I	I	I			
5	19	8.9	(8.2–9.8)	± 0.16	4.0		I	I	I	I		
7	15	8.9	(8.2–9.6)	± 0.17	3.8		I	I	I	I		
16	17	8.8	(8.5–9.2)	± 0.10	2.3			I	I	I		
14	10	8.6	(8.4–9.2)	± 0.17	3.2				I	I	I	
4	13	8.5	(7.9–9.2)	± 0.22	4.5					I	I	
12	13	8.3	(7.9–8.9)	± 0.17	3.7						I	
13	15	8.3	(7.7–8.7)	± 0.15	3.6						I	I
2	16	7.9	(7.4–8.3)	± 0.11	2.9							I

of four ranked positions filled by these samples. Sample 2 had the smallest means and ranked twelfth for all measurements.

All external and cranial measurements of males and females exhibited significant geographic variation. Among measurements for males, three had four subsets (length of tail, diastema, and interorbital constriction), seven had five subsets (length of hind foot, palatal length, palatofrontal depth, length of nasals, zygomatic breadth, squamosal breadth, and breadth across maxillaries), and six had six subsets (total length, greatest length of skull, condylobasal length, basal length, mastoid breadth, and rostral breadth). For females, the number of nonsignificant subsets included four for two measurements (length of tail and interorbital constriction), five for one measurement (length of hind foot), six for four measurements (total length, length of nasals, zygomatic breadth, and squamosal breadth), seven for six measurements (condylobasal length, basal length, diastema, mastoid breadth, rostral breadth, and breadth across maxillaries), and eight for three measurements (greatest length of skull, palatal length, and palatofrontal depth). The number of samples contained in a nonsignificant subset ranged from one in both sexes to eight in males and nine in females. The amount of overlap between nonsignificant subsets ranged between broad to no overlap between adjacent subsets. In the SS-STP analyses for most characters, sample 2 formed a nonoverlapping, nonsignificant subset. For males and females over half of the cranial measurements (greatest length of skull, condylobasal length, basal length, palatal length, palatofrontal depth, zygomatic breadth, and mastoid breadth; also squamosal breadth in males) had a subset formed by this sample. Only one other measurement had a subset that did not overlap with other subsets (length of hind foot of females of samples 8 and 10).

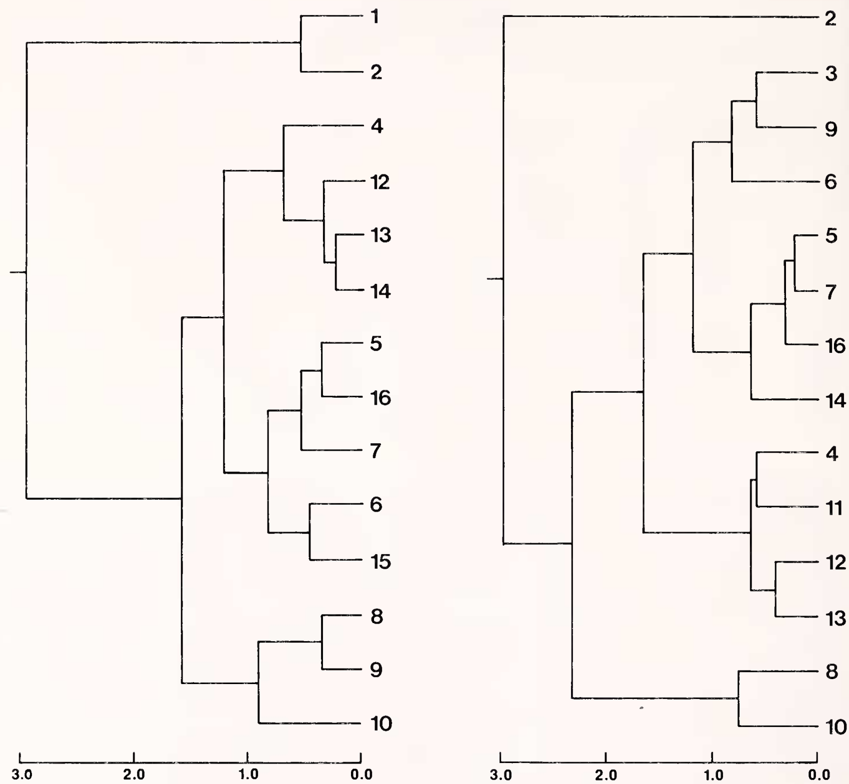

Fig. 2.—Phenograms of *Geomys personatus* (males left, females right) computed from distance matrices and clustered by unweighted pair-group method using arithmetic averages (UPGMA). Samples are identified in text and Fig. 1. The cophenetic correlation coefficient for the phenogram for males is 0.847 and for the females 0.734.

Other SS-STP analyses were generally characterized by broad overlapping subsets. However, some trends of sample grouping were evident. For females, samples 8 and 10 formed a subset in six measurements; in seven other measurements a subset was formed by samples 8, 9, and 10. For males, five measurements had a subset formed by samples 8, 9, and 10; in five other measurements these samples were included with sample 6 (four times) or 16 (one). In the smaller-sized pocket gophers, a subset formed by samples 2, 4, 12, and 13 was found in two male measurements; a subset of samples 2, 12, and 13 was found in two male and three female measurements; a subset of samples 2 and 4 was found in two male and one female measurement; and a subset of samples 2 and 3 was found in three female measurements. No other trends were noted.

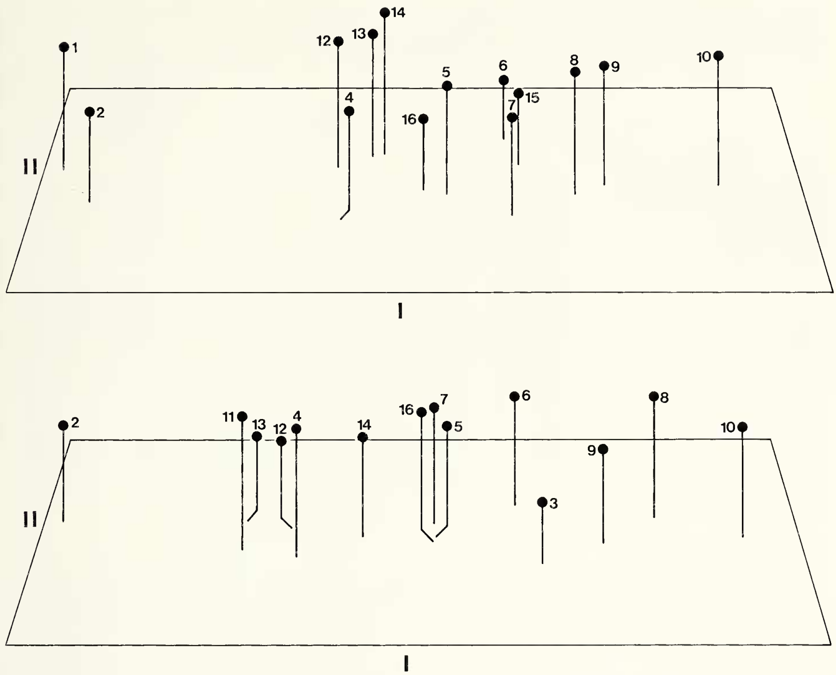

Fig. 3.—Three-dimensional projections of *Geomys personatus* (males above; females below) onto the first three principal components based upon matrices of correlation among 13 cranial measurements. Components I and II are indicated in the figure, and component III is represented by height. See Fig. 1 and text for key to samples.

Multivariate analysis.—Fourteen samples for males and females were used in multivariate analyses of geographic variation in *Geomys personatus*. No adult specimens were available from samples 3 and 11 in males and 1 and 15 in females.

Distance phenograms, generated for males and females with the MINT program, are illustrated in Fig. 2. The cophenetic correlation values for males and females were 84.7% and 73.4%, respectively.

In males, samples 1 (Kinney and Val Verde counties) and 2 (Dimmit and Zavala counties) are widely separated from all other samples. Although the other samples form a distinct group when compared with samples 1 and 2, clustering within that group agrees with geographic relationships. Samples 10 (barrier islands of Kleberg and Nueces counties), 9, and 8 (mainland of Kleberg and eastern Nueces counties) formed one cluster, which subdivides into the island (10) and mainland (9 and 8) samples. The other samples formed two clusters, one of which contained samples 5, 6, 7, 15, and 16. These are from the south-

Table 3.—*Factor matrix from correlation among 13 cranial characters of* Geomys personatus *studied.*

Character	Males			Females		
	Component I	Component II	Component III	Component I	Component II	Component III
Greatest length of skull	0.998	−0.015	0.032	0.993	−0.080	0.020
Condylobasal length	0.995	−0.055	0.061	0.992	−0.088	−0.020
Basal length	0.995	−0.047	0.060	0.993	−0.099	−0.002
Palatal length	0.993	−0.034	0.088	0.994	−0.074	−0.061
Palatofrontal depth	0.992	−0.010	0.026	0.984	−0.000	0.136
Length of nasals	0.953	0.006	0.272	0.977	0.023	−0.174
Diastema	0.976	−0.148	0.102	0.977	0.018	−0.191
Zygomatic breadth	0.975	−0.145	−0.062	0.977	0.146	−0.079
Squamosal breadth	0.979	−0.091	−0.030	0.993	−0.060	−0.055
Mastoid breadth	0.951	−0.061	−0.153	0.971	−0.063	0.134
Rostral breadth	0.943	0.015	−0.206	0.959	0.044	0.071
Interorbital constriction	0.760	0.644	0.041	0.911	0.389	0.086
Breadth across maxillaries	0.955	0.088	−0.237	0.976	−0.122	0.144

ern part of Texas (southeastern Webb, southern Duval, southern Kleberg, Jim Hogg, Brooks, Kenedy, Starr, Hidalgo, Willacy, and Cameron counties) and along the coast of Tamaulipas. The last cluster is divided into two subclusters. One contains samples 12, 13, and 14, all of which are located in the vicinity of the Nueces River (Karnes, Bee, Goliad, Live Oak, Jim Wells, San Patricio, and northern Nueces counties), whereas the other contained sample 4, which is from along the Rio Grande River (western Webb and Zapata counties) and is geographically isolated from samples 12, 13, and 14.

In females, the relationships between samples was similar to those observed in males with a few exceptions. Sample 2 (Dimmit and Zavala counties) was widely separated from all other samples. The other samples formed four distinct clusters. Samples 10 (barrier islands of Texas) and 8 (vicinity of Baffin Bay, Texas) formed a loose cluster. The next cluster contained samples 11, 12, 13 (all located in the vicinity of the Nueces River), and 4 (located along the Rio Grande River in western Webb and Zapata counties). Another cluster contained samples 5 and 7 (central southernmost part of Texas), 16 (coast of Tamaulipas), and 14 (Goliad and Karnes counties). The last cluster contained samples 3 (La Salle Co.), 6 (mainland of Kenedy and Kleberg counties), and 9 (mainland of Nueces Co.).

The first three principal components extracted from the matrix of correlation among characters are shown for males and females in Fig. 3. The amounts of phenetic variation explained by the first three principal components for males were 92.3%, 3.7%, and 1.8%, respectively;

for females, 95.4%, 1.7%, and 1.2%. Results of factor analyses, showing the influence of each character for the first three components are given in Table 3.

All characters of both sexes are heavily weighted in component I, thus indicating that the major differences among samples are in size rather than in shape (Table 3). In component II of both sexes, interorbital constriction is the only character having a noticeably higher weighting. This trend is carried over into component III for males; no characters had high weightings for females in component III.

In the three-dimensional projections for males and females (Fig. 3), all samples are aligned almost in a straight line along component I, with little change in position along components II and III. The samples from Dimmit and Zavala counties (also males from Kinney and Val Verde counties—no females are available) are situated to the left in the plots, and are the most distinct of all samples examined. The remainder of the samples form an elongated cluster along component I. Unless the geographic and taxonomic aspects are considered, the location and amount of separation of individual samples is somewhat complicated, particularly when both sexes are considered. Generally four groups are evident for both sexes that comply with the taxonomic arrangement of Davis (1940). The largest-sized individuals, represented by sample 10 (from Mustang and Padre islands), form one group on the right side of the plots. The next group, represented by samples 8 and 9, is situated geographically between Baffin Bay and Corpus Christi Bay. This group is plotted to the left of sample 10. The next group consists of a series of loosely clustered samples (3, 5, 6, 7, 15, and 16), which primarily occur in the southernmost part of Texas and on the coast of Tamaulipas. The fourth group, including samples 4, 11, 12, 13, and 14, has the smallest-sized individuals of the four groups that plotted together. Samples 11, 12, 13, and 14 are from the vicinity of the Nueces River; sample 4, which contains the same-sized individuals, is restricted to the lower Rio Grande River and is geographically isolated from samples 11, 12, 13, and 14.

Canonical analysis provides a mechanism for graphically representing phenetic relationships among samples with the characters weighted by variance-covariance analysis. In Table 4, characters used in these analyses for males and females are listed from the most useful to the least useful in discriminating groups. For males, Variate I accounts for 65.6% of the total dispersion, and Variate II accounts for 10.6%. The diastema is the only character with a high positive (greater than 1.0) canonical coefficient for Variate I. No character in Variate I had a negative value greater than 1.0. In Variate II, a positive value greater than 1.0 was exhibited by breadth across maxillaries, and a negative value greater than 1.0 was exhibited by rostral breadth. For females,

Table 4.—*Variables used in discriminant function analysis of* Geomys personatus. *Characters are listed in order of their usefulness in distinguishing groups with the character with the greatest between-group variance and the least within-groups variance being selected first. Other traits are ranked using the same criteria. The statistics are recalculated at each step.*

	Males			Females		
Step	Character	F-value	U-statistic	Character	F-value	U-statistic
1	Greatest length of skull	36.47	0.2020	Greatest length of skull	68.77	0.1227
2	Rostral breadth	4.66	0.1338	Rostral breadth	4.02	0.0863
3	Squamosal breadth	3.67	0.0953	Palatofrontal depth	3.73	0.0619
4	Interorbital constriction	2.89	0.0921	Condylobasal length	3.46	0.0452
5	Palatal length	2.43	0.0567	Zygomatic breadth	2.36	0.0360
6	Condylobasal length	2.36	0.0447	Diastema	2.19	0.0291
7	Breadth across maxillaries	2.19	0.0358	Breadth across maxillaries	2.13	0.0237
8	Zygomatic breadth	1.67	0.0300	Basal length	1.88	0.0196
9	Basal length	1.52	0.0255	Length of nasals	1.95	0.0161
10	Length of nasals	1.62	0.0214	Squamosal breadth	1.75	0.0135
11	Mastoid breadth	1.17	0.0188	Mastoid breadth	2.51	0.0105
12	Diastema	0.91	0.0170	Interorbital constriction	1.22	0.0092
13	Palatofrontal depth	0.87	0.0154	Palatal length	1.12	0.0082

Variate I accounts for 75.2% and Variate II accounts for 8.2% of the total dispersion. In Variate I, interorbital constriction and squamosal breadth exhibited a high positive (greater than 1.0) canonical coefficient; there were no characters with negative values greater than 1.0. In Variate II, palatal length and palatofrontal depth had positive values greater than 1.0 and breadth across maxillaries had negative values greater than 1.0.

Plots of the first two canonical variates for males and females is characterised by a series of overlapping samples with samples on the left being separated from those on the right (Fig. 4). For both sexes, sample 10 occurs on the left side of the plot. Samples 8 and 9 overlap with each other, sample 10, and then become part of a conglomeration of overlapping samples in the center of the plot. At the right side of the plot, sample 2 appears more separated than other samples (except sample 10), but still maintains a definite overlap. The only possibility of a nonoverlapping sample occurs with sample 1 in the plot for males. In this case, the sample is on the right side and in close proximity to sample 2.

Taxonomic Conclusions

Prior to this study, six subspecies of *Geomys personatus* were recognized (Davis, 1940, 1943; Hall, 1981). Our analyses indicate a great amount of variation among populations of this species, which generally agrees with previous subspecific designations. However, our study reveals an additional population of *G. personatus* that deserves subspecific recognition. Also, we found *G. p. fuscus* and *G. p. streckeri* to form a closely related subspecific grouping that is distinct from the other subspecies of *G. personatus*. Finally, we noted that members of the species occurring in Tamaulipas belong to *G. p. megapotamus*, instead of *G. p. personatus* as was indicated by Hall (1981) and by Selander et al. (1962). Thus, we recognize *G. personatus* to contain seven subspecies. These include the currently recognized taxa (*fallax, fuscus, maritimus, megapotamus, personatus,* and *streckeri*), plus one new subspecies that is described below (Fig. 5).

SYSTEMATIC ACCOUNTS

Geomys personatus davisi, new subspecies

Holotype.—Adult female, skin and skull, no. 48689 Carnegie Museum of Natural History; from 3 mi N, 2.8 mi W Zapata, Zapata Co., Texas; collected on 16 November 1976 by Stephen L. Williams; original no. 2081; karyotype no. TK 6857.

Distribution.—Currently known from the Rio Grande Valley of Texas, in western Webb and Zapata counties.

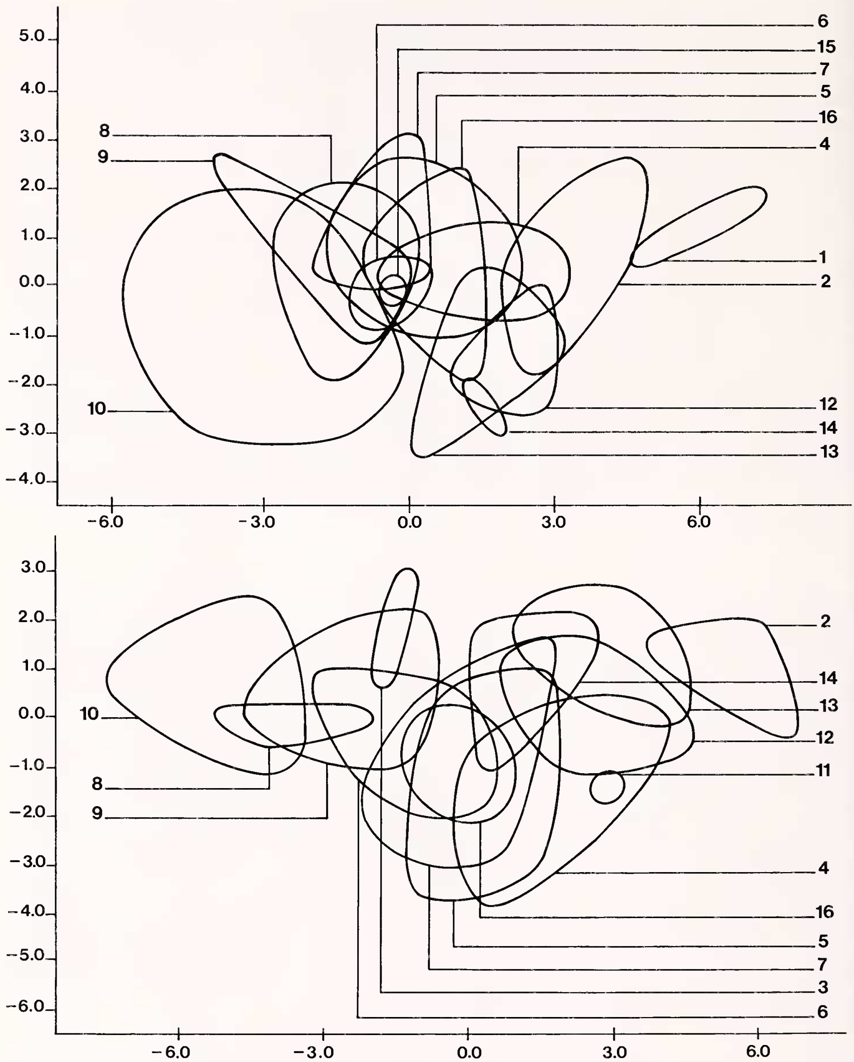

Fig. 4.—Plots (males above; females below) of first two canonical variates, showing phenetic relationships among samples of *Geomys personatus*. See Fig. 1 and text for key to samples.

Diagnosis.—Among smaller member of species, being similar to *G. p. fallax* in size; pale brown in coloration.

Description.—Externally, size medium or slightly smaller for the species (Table 2). Dorsal hair coloration is Buffy Brown on tips (capitalized color terms from Ridgeway,

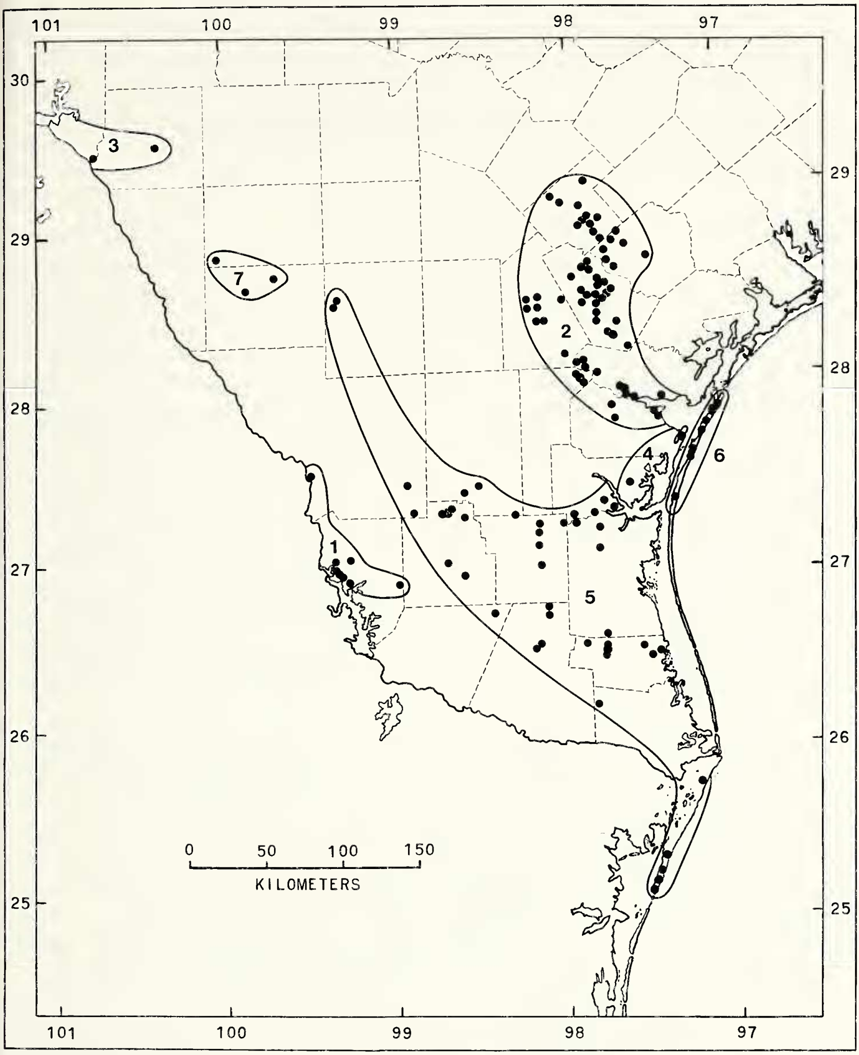

Fig. 5.—Geographic distribution of subspecies of *Geomys personatus*: 1) *G. p. davisi*; 2) *G. p. fallax*; 3) *G. p. fuscus*; 4) *G. p. maritimus*; 5) *G. p. megapotamus*; 6) *G. p. personatus*; 7) *G. p. streckeri*.

1912) and gray on bases. Coloration extends laterally and ventrally where white-tipped hairs are dispersed in the pelage, resulting in a paler ventral coloration. Some areas on venter are covered with pure white hair.

Cranially, the basioccipital is longer than the rostral breadth. Sagittal and lamdoidal crests are well developed. Zygomatic arches are expanded anteriorly.

Measurements.—Measurements of *G. p. davisi* (sample 4) are given in Table 2. External and cranial measurements (in millimeters) of the holotype are as follows: total length, 269; length of tail, 84; length of hind foot, 35; greatest length of skull, 44.8; condylobasal length, 43.7; basal length, 41.1; palatal length, 28.4; palatofrontal depth, 17.0; length of nasals, 16.1; diastema, 15.2; zygomatic breadth, 26.8; mastoid breadth, 26.7; squamosal breadth, 20.3; rostral breadth, 9.1; interorbital constriction, 6.1; breadth across maxillaries, 8.9.

Comparisons.—Geographically, *G. p. davisi* is closest to *G. p. megapotamus,* which virtually blocks contact with *G. p. fallax, G. p. maritimus,* and *G. p. personatus. G. p. davisi* differs from *G. p. megapotamus* in being smaller. Comparing the greatest length of the skull, males and females of *G. p. davisi* averaged 49.9 and 44.1 mm, respectively, whereas those of *G. p. megapotamus* (sample 5) averaged 51.7 and 46.3 mm. It is also much smaller than *G. p. maritimus* (mean greatest length of skull of specimens in sample 9—males, 55.3; females, 49.5) and *G. p. personatus* (mean greatest length of skull—males, 57.9; females, 52.9). Although it might be possible for *G. p. davisi* to come into contact with *G. p. fuscus* (mean greatest length of skull—males, 41.4; females, —) and *G. p. streckeri* (mean greatest length of skull—males, 45.1; females, 40.0) both subspecies are distinctly smaller than *G. p. davisi.* The subspecies most closely approximating *G. p. davisi* in size is *G. p. fallax* (mean greatest length of skull of specimens in sample 12—males, 49.8; females, 43.9). However, they are isolated from each other and most obviously differ in color (*G. p. davisi* being paler).

Remarks.—The geographic distribution of *G. p. davisi* generally borders the Rio Grande River. However, one individual (TNHC 176) from 20 mi E Zapata also may belong to this subspecies. The primary reason for this assignment is that it probably occurs in the same type of soil as other members of the taxon, based on the state soil map (Godfrey et al., 1973). Because this individual was not an adult it was not incorporated in statistical analyses that could have provided a more definite identification. It is possible that additional investigations will show that specimens from this geographical area belong to the subspecies *G. p. megapotamus.*

Etymology.—The subspecific name honors Dr. William B. Davis for his contributions to the knowledge of *Geomys personatus* as well as other species of pocket gophers.

Specimens examined (55).—TEXAS. *Webb Co.:* Laredo, 1 (USNM). *Zapata Co.*: 5 mi E San Ignacio, 1 (TNHC); 10 mi N Zapata, 33 (31 TNHC, 2 UIMNH); 10 mi NW Zapata, 3 (TCWC); 6 mi NW Zapata, 1 (CM); 3 mi N, 4.2 mi W Zapata, 1 (CM); 3 mi N, 2.8 mi W Zapata, 13 (CM); Carrizo (=Zapata), 1 (USNM); 20 mi E Zapata, 1 (TNHC).

Geomys personatus fallax Merriam, 1895

Geomys personatus fallax Merriam, N. Amer. Fauna, 8:144, 31 January 1895.

Holotype.—Adult male, skin and skull, USNM 32031/43845; from

S side Nueces Bay, Nueces Co., Texas; collected on 30 November 1891 by William Lloyd, original no. 949.

Measurements of holotype.—Total length, 250; length of tail, 80; length of hind foot, 35; greatest length of skull, 46.7; condylobasal length, 45.4; basal length, 43.1; palatal length, 29.8; palatofrontal depth, 16.1; length of nasals, 16.8; diastema, 16.6; zygomatic breadth, 30.2; mastoid breadth, 27.5; squamosal breadth, 20.2; rostral breadth, 10.0; interorbital constriction, 6.4; breadth across maxillaries, 8.2.

Distribution.—Occurring in the vicinity of Nueces Bay, northwestward along the Nueces River and north as far as the vicinity of Falls City. Collecting localities include Bee, Goliad, Jim Wells, Karnes, Live Oak, Nueces, and San Patricio counties, Texas.

Remarks.—Kennerly (1959) reported that the distribution of *G. p. fallax* comes into contact with that of *Geomys bursarius attwateri* between Skidmore, Bee Co., and Falls City, Karnes Co. Because both species occur in the same geographic region, it was necessary to differentiate between the taxa to avoid using specimens of *G. bursarius* in any analyses. Most characteristics of the species are similar enough to make identification difficult. Kennerly (1958*b*) noted minor bacular differences. Timm and Price (1980) found each species to have different types of lice. Although *G. b. attwateri* possesses a karyotype of 2N = 70 and FN = 72 (Hart, 1978, Honeycutt and Schmidly, 1979), the karyotype of *G. p. fallax* (2N = 68, 70 and FN = 70, 71; Davis et al., 1971) is variable and the possibility that some individuals of the two taxa have the same diploid and fundamental numbers cannot be ruled out. These methods of differentiating species can be useful, but they have limited application in identifying museum study specimens. Davis (1940) distinguished *G. personatus* and *G. bursarius* by comparing the length of the basioccipital to the width of the rostrum. Although this method proved useful in most cases, it emphasized the necessity of employing additional methods, because 1) some localities (for example—Bee Co.: 5–8 mi NE Beeville, 1.5 mi S Skidmore; Karnes Co.: ½ mi S Falls City) yielded specimens of both taxa, 2) some specimens had a rostral breadth and basioccipital length that are essentially equal, thus leaving any identification questionable, and 3) a few specimens that were definitely one of the two species, based on geographical criteria, did not comply with the expected cranial characters. It is uncertain whether specimens, for which the final comment applies, represent cases of character displacement or erroneous information on associated labels; therefore, they were not used in this study.

To help differentiate and identify *Geomys personatus* and *attwateri,* a discriminant function analysis was performed. Table 5 gives the discriminant function coefficients resulting from the comparison of reference samples of male and female *G. p. fallax* and *G. attwateri*. The

Table 5.—*Discriminant function coefficients resulting from a discriminant function analysis comparing reference samples of* Geomys personatus fallax *and* G. attwateri.

Character	Discriminant function coefficients	
	Male	Female
Greatest length of skull	0.17075	0.95361
Condylobasal length	−0.71121	−1.36357
Basal length	0.03878	0.33446
Palatal length	0.52366	0.13603
Palatofrontal depth	−0.34221	0.11252
Length of nasals	−0.18011	−0.28420
Diastema	0.25139	0.07742
Zygomatic breadth	0.00213	0.22745
Mastoid breadth	0.20445	−0.03256
Squamosal breadth	−0.18248	−0.40644
Rostral breadth	0.40461	−0.00295
Interorbital constriction	0.24765	0.58744
Breadth of maxillaries	−0.20965	−0.23906

discriminant scores of male *G. p. fallax* ranged from −6.135 to −6.652; male *G. attwateri* ranged from −4.567 to −5.372. The discriminant scores of female *G. p. fallax* ranged from −1.761 to −2.334; female *G. attwateri* ranged from −0.162 to −1.000. In this study most specimens identified by discriminant function analysis were in agreement with expected geographic ranges of the respective species, with areas of potential contact being in general agreement with findings of Kennerly (1959). However, at least three specimens received discriminant scores that are between the ranges of scores of both species. These specimens were from 9 mi SE Runge, Goliad Co. (TNHC 4923, ♀); 7 mi NE Beeville, Bee Co. (TNHC 4827, ♀); 5.6 mi S Beeville, Bee Co. (TNHC 4816, ♂). Because the three specimens originated from areas of potential contact, it is possible that they may represent hybrids between *G. p. fallax* and *G. attwateri*; however, considerably more data are needed before this can be confirmed.

The contact between *G. bursarius* and *G. personatus* is truely a unique situation. It is one of the few areas in North America where two species of *Geomys* coexist (see Tucker and Schmidly, 1981). Although Kennerly (1958*a*, 1959) reported observations of *G. personatus* and *G. attwateri* in the area of contact, considerably more investigation is needed in order to better understand this interesting phenomenon, as well as the biology of the genus *Geomys*.

Specimens examined (301).—TEXAS. *Bee Co.:* 8.4 mi N, 1.7 mi E Beeville, 3 (TTU); 8 mi N Beeville, 5 (TTU); 8 mi NW Beeville, 1 (TNHC); 8 mi NE Beeville, 1 (TNHC); 7.6 mi NNE Beeville, 1 (TNHC); 7.3 mi N, 0.6 mi E Beeville, 1 (TTU); 5 mi NE

Beeville, 1 (TNHC); 0.1 mi W US Hwy. 181 on Fm. Rd. 2824, 2 (TTU); 3 mi N Beeville, 1 (TNHC); 2.8 mi N, 5.1 mi W Beeville, 1 (TTU); 2.7 mi N, 4.6 mi W Beeville, 2 (TTU); 2.5 mi NE Beeville, 1 (TNHC); 2 mi N Beeville, 1 (TNHC); 1.1 mi N, 3.6 mi W Beeville, 1 (TTU); 0.8 mi N, 4.3 mi W Beeville, 16 (TTU); Bates Ranch near Beeville, 4 (TTU); 0.6 mi NW Beeville, 1 (TNHC); 6.2 mi W Beeville, 1 (TNHC); Beeville, 38 (29 TNHC, 9 TTU); E of Beeville, 1 (TNHC); 2.1 mi S Beeville, 1 (TNHC); 3 mi S Beeville, 1 (TNHC); 5 mi S Beeville, 1 (TNHC); 5.45 mi S Beeville, 1 (TNHC); 5.6 mi S Beeville, 1 (TNHC); 21 mi SE Beeville, 1 (TNHC); 2 mi E Cadiz, 1 (TNHC); 4.1 mi NE Mineral, 1 (TNHC); 0.3 mi W Mineral, 1 (TNHC); 0.7 mi S Mineral, 1 (TNHC); 1.3 mi E Normanna, 1 (TNHC); ½ mi S Normanna, 1 (TNHC); 2.9 mi SE Normanna, 1 (TNHC); 2.5 mi W Orangedale, 1 (TNHC); 0.2 mi S Orangedale, 1 (TNHC); 0.3 mi W Pettus, 1 (TNHC); 2 mi S Pettus, 1 (TNHC); 4.3 mi NE Skidmore, 1 (TNHC); 1 mi W Skidmore, 1 (TNHC); ¼ mi S Skidmore curve, 1 (TNHC); ½ mi SW Skidmore, 1 (TNHC); 1 mi SE Skidmore, 1 (TNHC); 1.1 mi S Skidmore, 2 (TNHC); 1.5 mi S Skidmore, 3 (TNHC); 0.5 mi W Tulsuta, 1 (TNHC). *Goliad Co.:* 10.4 mi NW Berclaire, 1 (TNHC); 5 mi NW Berclaire, 1 (TNHC); 2.1 mi W Charco, 2 (TNHC); 2 mi SE Charco, 1 (TNHC); 2.95 mi NNE bridge over Hord Creek, 1 (TNHC); 6 mi E Pettus, 1 (TNHC); 8 mi E Pettus, 1 (TNHC); 9 mi SE Runge, 1 (TNHC); 1 mi SSW San Antonio R., 1 (TNHC). *Jim Wells Co.:* Sandia 4 (3 TCWC, 1 TTU); 0.3 mi S, 0.4 mi E Sandia, 1 (TTU); 1.3 mi S, 1.6 mi E Sandia, 1 (TTU); 1.5 mi S, 1.9 mi E Sandia, 1 (TTU); 1.8 mi S, 2.3 mi E Sandia, 1 (TTU); 2 mi S, 2.4 mi E Sandia, 1 (TTU); 2.1 mi S, 2.3 mi E Sandia, 1 (TTU). *Karnes Co.:* 2 mi NE Choate, 1 (TNHC); 2.1 mi SE Choate, 1 (TNHC); 2.3 mi SE Choate, 1 (TNHC); ½ mi S Falls City, 1 (TNHC); 8.4 mi N Helena, 1 (TNHC); Helena, 1 (TNHC); 2.2 mi S Helena, 1 (TNHC); ¼ mi E Hobson, 1 (TNHC); 3 mi NE Karnes City, 2 (TNHC); 4.7 mi NE Kenedy, 1 (TNHC); 4.5 mi NE Kenedy, 1 (TNHC); 4 mi NE Kenedy, 1 (TNHC); 3.4 mi NE Kenedy, 1 (TNHC); 2.1 mi NE Kenedy, 2 (TNHC); 1.2 mi NE Kenedy, 1 (TNHC); 0.8 mi NE Kenedy, 1 (TNHC); 4 mi E Kenedy, 1 (TNHC); 4.5 mi E Kenedy, 2 (TNHC); 5.5 mi E Kenedy, 1 (TNHC); 6.0 mi SE Kenedy, 1 (TNHC); 2 mi SW Runge, 1 (TNHC). *Live Oak Co.:* 13.5 mi W Beeville, 1 (TNHC); 8 mi N George West, 4 (TNHC); 8 mi NW George West, 15 (TNHC); 5 mi NW George West, 7 (TNHC); 4 mi N George West, 3 (TTU); 3 mi N George West, 42 (40 TNHC, 2 UIMNH); 1½ mi S George West, 1 (TCWC); 3 mi SE George West, 1 (TNHC); 0.8 mi S, 0.3 mi E Lagarto, 2 (TTU); 1.5 mi S, 0.6 mi E Lagarto, 1 (TTU); 5 mi S Three Rivers, 2 (TCWC); 3 mi E Nueces R. on Hwy. 202, 1 (TNHC). *Nueces Co.:* Calallen, 8 (5 LACM, 3 UIMNH); 1 mi E Calallen, 3 (TCWC); Corpus Christi, 1 (USNM); near Corpus Christi, 15 (AMNH); port area of Corpus Christi, 1 (TAIU); 17 mi W Corpus Christi, 8 (TTU); Las Mottes, 1 (USNM); specific locality unknown, 2 (BM). *San Patricio Co.:* 4 mi SE Edroy, 4 (TCWC); 5.3 mi SE Edroy, 1 (TNHC); 5.5 mi W Mathis, 2 (CM); 2 mi W Mathis, 1 (TNHC); 3 mi SW Mathis, 2 (TCWC); 5 mi SE Mathis, 1 (TNHC); 2 mi N Odem, 2 (TNHC); 1.5 mi N Odem, 1 (TNHC); 1.3 mi N Odem, 1 (TNHC); ½ mi N Odem, 1 (TNHC); ¼ mi SE Odem, 1 (TNHC); 2.6 mi SW Odem, 1 (TNHC); 5 mi SE Odem, 3 (TNHC); 8 mi S Taft, 1 (TNHC). *County unknown:* 10 mi from mouth of Nueces R., 2 (USNM); near mouth of Nueces R., 1 (AMNH); Nueces Bay, 2 (USNM).

Geomys personatus fuscus Davis, 1940

Geomys personatus fuscus Davis, Texas Agric. Exp. Station Bull., 590:30, 23 October 1940.

Holotype.—Subadult male, skin and skull, AMNH 12691/10985; from Fort Clark (Bracketville), Kenney Co., Texas; collected on 6 February 1893 by Edgar A. Mearns, original no. 2274.

Measurements of holotype.—Total length, 229; length of tail, 68; length of hind foot, 33.5; greatest length of skull, 40.5; condylobasal length, 39.4; basal length, 36.7; palatal length, 24.8; palatofrontal depth, 13.4; length of nasals, 14.7; diastema, 13.5; zygomatic breadth, 22.3; mastoid breadth, 21.0; squamosal breadth, 16.7; rostral breadth, 8.4; interorbital breadth, 5.5; breadth across maxillaries, 7.2.

Distribution.—Occurring near the Rio Grande River in Kinney and Val Verde counties, Texas.

Remarks.—*G. p. fuscus* is the northernmost taxon of the species. Geographically, it is closest to *G. p. streckeri* which occurs about 50 miles to the southeast in the vicinity of Carrizo Springs. Our data indicate that these two taxa are similar. If *G. p. streckeri* ever should be elevated to a distinct species (see account for *G. p. streckeri*) then *G. p. fuscus* also would be included, either as a synonym or as a subspecies of *streckeri*. The exact relationship between *G. p. fuscus* and *G. p. streckeri* is difficult to understand at this time because each taxon has unique ectoparasites (Timm and Price, 1979) and there is unsuitable habitat between their respective distributions. Furthermore, until additional material of *G. p. fuscus* can be obtained, no proper evaluation of the relationship of the two taxa can be made.

Efforts to acquire additional specimens of *G. p. fuscus* were unsuccessful. Localities of known records (Del Rio, Fort Clark, and mouth of Sycamore Creek) were visited. Generally, most of the habitat at these localities appears unsuitable for *G. personatus*. One series of mounds were located on the grounds of Fort Clark in Bracketville. However, because the pocket gopher never responded to trapping efforts, it was not confirmed whether the mounds were made by *G. personatus* or *Pappogeomys castanops* (see Russell, 1968). Russell (1968) commented that *G. p. fuscus* is common in the vicinity of Eagle Pass, Maverick Co., Texas. However, we have not examined, nor do we know of any specimens in museum collections from this locality. Because this area is about 100 kilometers (60 miles) southeast of previous records of *G. p. fuscus* and approaching midway between the distributions of *G. p. fuscus* and *G. p. davisi,* pocket gophers occurring in the vicinity of Eagle Pass are certainly worthy of further investigation to verify their taxonomic status.

Specimens examined (5).—TEXAS. *Kinney Co.:* Fort Clark, 5 (4 AMNH, 1 FMNH).

Geomys personatus maritimus Davis, 1940

Geomys personatus maritimus Davis, Texas Agric. Exp. Station Bull., 590:26, 23 October 1940.

Holotype.—Young adult (basioccipital and basisphenoid not completely fused) female, skin and skull, TCWC 608; from Flour Bluff, 11 mi SE Corpus Christi, Nueces Co., Texas; collected on 21 April 1938 by William B. Davis, original no. 3059.

Measurements of holotype.—Total length, 278; length of tail, 80; length of hind foot, 36; greatest length of skull, 51.2; condylobasal length, 48.9; basal length, 45.6; palatal length, 32.1; palatofrontal depth, 19.1; length of nasals, 18.0; diastema, 17.0; zygomatic breadth, 29.7; mastoid breadth, 28.1; squamosal breadth, 21.7; rostral breadth, 11.4; interorbital constriction 6.6; breadth across maxillaries, 9.6.

Distribution.—Restricted to sandy soils of the mainland in Kleberg and Nueces counties, between Baffin Bay and Flour Bluff.

Remarks.—The range of *G. p. maritimus* lies between that of *G. p. fallax, G. p. megapotamus,* and *G. p. personatus.* However, *G. p. maritimus* more closely resembles the latter two taxa by being intermediate in size and having similar coloration. Davis (1940) provided further comments on the relationship between *G. p. maritimus* and other subspecies of *G. personatus.*

Specimens examined (130).—TEXAS. *Kleberg Co.:* NE King Ranch, 45 (43 TNHC, 2 UIMNH). *Nueces Co.:* 8.0 mi S, 8.3 mi E Corpus Christi, 5 (TTU); 11 mi SE Corpus Christi, 6 (2 KU, 3 TCWC, 1 UIMNH); 14 mi SE Corpus Christi, 3 (KU); Corpus Christi Bay, Flour Bluff, 6 (ANSP); Flour Bluff, 65 (8 TNHC, 53 TTU, 4 UIMNH).

Geomys personatus megapotamus Davis, 1940

Geomys personatus megapotamus Davis, Texas Agric. Exp. Station Bull., 590:27, 23 October 1940.

Holotype.—Adult female, skin and skull, TCWC 794; from 4 mi SE Oilton, Webb County, Texas; collected on 25 November 1938 by William B. Davis, original no. 3254.

Measurements of holotype.—Total length, 250; length of tail, 67; length of hind foot, 35; greatest length of skull, 44.5; condylobasal length, 43.3; basal length, 41.1; palatal length, 28.3; palatofrontal depth, 17.1; length of nasals, 15.5; diastema, 15.1; zygomatic breadth, 26.7; mastoid breadth, 25.5; squamosal breadth, 19.6; rostral breadth, 9.7; interorbital constriction, 6.7; breadth across maxillaries, 9.2.

Distribution.—Occurring in sandy soils of southern Texas and extreme northeastern Tamaulipas. In Texas, specimens have been collected in Brooks, Cameron, southern Duval, northern Hidalgo, Jim Hogg, Kenedy, southern Kleberg, eastern Starr, eastern Webb, and Willacy counties. The northernmost record is 6 mi W Cotulla, La Salle Co., Texas; the southernmost record is Boca Santa Maria (barrier island), Tamaulipas.

Remarks.—Even in the original description by Davis (1940), *G. p. megapotamus* had the most extensive distribution of all the subspecies of *G. personatus.* Until the current study, the southern extent of the distribution of this subspecies was thought to be Cameron County, Texas. The population of *G. personatus* in Tamaulipas, reported by Selander et al. (1962), was assumed to be an extension of the population occurring on the Texas barrier islands, and was assigned to *G. p. personatus* (Hall, 1981). However, our data indicate that these populations belong to *G. p. megapotamus*. Furthermore, the lack of pocket gophers (or sign thereof) from South Padre Island, as indicated by fieldwork (by Williams) and lack of material in museum collections, suggest that *G. p. megapotamus* in Texas (as described by Davis, 1940) is geographically the nearest population.

The southern limit of the geographic range of *G. p. megapotamus* is questionable at the present time. Fieldwork conducted by Selander et al. (1962) and Williams has revealed pocket gophers occurring as far south as Boca Santa Maria on the coastal beaches of Tamaulipas. However, both field parties were unable to cross the strait of Boca Santa Maria to determine if the population continues. The presence of the closely related *G. tropicalis,* about 325 kilometers south of this locality, certainly strengthens the possibility of pocket gophers continuing further south along the beach. However, fieldwork (by Williams) determined that *G. personatus* probably does not get as far south as La Pesca, Tamaulipas (about 140 kilometers south of Boca Santa Maria). In addition to the absence of pocket gophers along the coastal beaches in this area, it is unlikely that they would inhabit these beaches because of their restricted size and predominate sea shell composition.

Specimens examined (288).—TAMAULIPAS. 10 mi N Boca Santa Maria, 18 (TTU); 45 mi S Rio Grande, Boca Santa Maria, 28 (TTU); 35 mi SSE Matamoros, 8 (KU); 5 mi S road to Washington Beach (on Washington Beach), 1 (TTU); 33 mi S Washington Beach, 1 (KU); 73 mi S Washington Beach, 8 (KU). TEXAS. *Brooks Co.:* Falfurrias, 6 (LACM); 10.5 mi E Falfurrias, 5 (TTU); 3 mi S Falfurrias, 3 (TCWC); 8.25 mi S Falfurrias, 5 (TTU); 15 mi S Falfurrias, 2 (TTU). *Cameron Co.:* Juarez Rancho, 1 (USNM); Santa Rosa, 1 (USNM). *Duval Co.:* 3 mi S, 24.6 mi E Hebbronville, 7 (TTU); 3 mi E Realitos, 4 (TNHC); 3½ mi SW Realitos, 2 (TCWC). *Hidalgo Co.:* 2 mi S County Mark on Hwy. 281, 1 (TTU); 5 mi S County Mark on Hwy. 281, 2 (TTU); 3 mi NW Linn, 2 (TTU); 4 mi W Linn, 2 (TTU). *Jim Hogg Co.:* 26.8 mi N Agua Nueva, 3 (TTU); 3 mi N Agua Nueva, 1 (TCWC); 1 mi NE Hebbronville, 1 (TCWC); 1.5 mi W Hebbronville, 2 (TTU); Hebbronville, 39 (2 LACM, 37 TNHC); 20 mi S Hebbronville, 9 (TNHC). *Kenedy Co.:* 3.5 mi S Mifflen, 1 (TAIU); Norias Ranch, 9 (FMNH); 10 mi N, 0.8 mi E Raymondville, 6 (TTU); 11 mi S Riviera, 1 (TAIU); La Paloma Ranch, 10 mi W Sarita, 2 (TAIU); La Paloma Ranch, 9½ mi W Sarita, 1 (TAIU); 6 mi E Sarita, 2 (ANSP); 3.8 mi S Sarita, 3 (TTU). *Kleberg Co.:* 7.7 mi E Riviera, 4 (TAIU); 8.7 mi E Riviera, 1 (TAIU); 1 mi S Jct. Fm. Rd. 2775 and 628, 1 (TAIU); Jct. Fm. Rd. 1546 and 2510, 9 (TTU); 2 mi S Riviera, 2 (TCWC); 2.8 mi S, 8.8 mi W Riviera, 4 (TTU). *La Salle Co.:* 6 mi W Cotulla, 1 (TCWC); 7 mi WSW Cotulla, 1 (TCWC). *Starr Co.:* 2 mi N La Gloria, 1 (TAIU). *Webb Co.:* 14 mi W Hebbronville, 1 (TTU); 4 mi SE Oilton, 8 (2 KU, 6 TCWC). *Willacy Co.:* 8 mi W Port Mansfield, 2 (TTU); 5 mi W Port Mansfield, 3 (TTU); 4 mi W Port Mansfield, 9 (TTU); 10 mi NW Raymondville, 1 (TNHC); 8 mi N Raymondville, 16 (TTU); 7 mi N Raymondville, 1 (TNHC); 5.4 mi N Raymondville, 1 (TAIU); 3 mi N Raymondville, 34 (TNHC); 16 mi W San Perlita, 1 (TCWC).

Geomys personatus personatus True, 1889

Geomys personatus True, Proc. U.S. Nat. Mus., 11:159 (for 1888), 5 January 1889.

Lectotype.—Female, age undetermined, skin and skull (damaged), USNM 19668/38000; from Padre Island, Texas (herein restricted to Padre Island, 6.1 mi S Nueces County Park [27°32′N, 97°15′W], Kleberg Co., Texas); collected on 11 April 1888 by Mr. C. K. Worthen, no original number.

Paralectotype.—Male, age undetermined, skin and skull (damaged), USNM 19667/37999; from Padre Island, Texas; collected on 11 April 1888 by Mr. C. K. Worthen, no original number.

Measurements (lectotype followed by paralectotype).—Total length, 294, 283; length of tail, 78, 73; length of hind foot, 33, 32. Cranial measurements were not taken because of damaged skulls.

Distribution.—Restricted to Mustang and Padre islands in Kleberg and Nueces counties, Texas.

Remarks.—The original description of *G. personatus* (True, 1889) was based on two specimens from Padre Island, Texas (Poole and Schantz, 1942). To the best of our knowledge, the status of the type specimens has not changed since that time. Therefore, we have designated a lectotype and a paralectotype. The lectotype selected has a cranium with less damage than that of the paralectotype and is the more mature individual.

The southern limit of the distribution of *G. p. personatus* is not certain. We found all records of *G. p. personatus* to occur either on Mustang Island or northern Padre Island. Past and recent field investigations (by W. Lloyd in 1891 and Williams in 1973) on southern Padre Island failed to find any evidence of pocket gophers. Bailey (1905) and Davis (1940) suggested that *G. p. personatus* occurs as far south as the central part of Padre Island. Our findings are in agreement with both studies. Because Mustang Island and Padre Island are more or less continuous along the southern coastline of Texas, it is not known why the pocket gophers have not moved into the habitats of South Padre Island. Assuming that currently existing waterways along the coastline have not been permanent enough to hinder dispersal by pocket gophers, it is possible that the soil type restricts the southern distribution of *G. p. personatus*. According to the state soil map (Godfrey et al., 1973) the soil on Padre Island becomes more calcareous south of Baffin Bay. However, it is not yet known whether such a physical change in soil, or resulting changes in vegetation and other factors, or combination of effects, would serve as a barrier to further dispersal.

Although True (1889) did not list the county of the collecting locality of the cotypes in the original description, subsequent authors (Hall, 1981; Hall and Kelson, 1959; Miller, 1912, 1924; Poole and Schantz, 1942) have given "Cameron Co." as part of the type locality. We believe that this subspecies occurs only on North Padre Island (north of Baffin Bay) and therefore the type specimens were not taken in Cameron Co. It is possible that the use of Cameron Co. resulted from the fact that the county at one time encompassed the entire coastal region of Texas from the Rio Grande to Baffin Bay. This area was subsequently divided (from north to south) into Kenedy, Willacy, and Cameron counties. In order to prevent future taxonomic confusion, we herein restrict the type locality of *G. p. personatus* to Padre Island, 6.1 mi S Nueces County Park (27°32′N, 97°15′W), Kleberg Co., Texas.

Specimens examined (203).—TEXAS. *Kleberg Co.:* Padre Island, 6.1 mi S Nueces County Park, 5 (TTU); N Padre Island, 26 (24 TNHC, 2 UIMNH); 23 mi S Port Aransas, 1 (TCWC); ¼ mi N Entrance Padre Island National Park, 1 (TAIU); 19 mi S Mustang Island, 1 (TCWC). *Nueces Co.:* Mustang Island, Port Aransas, 20 (TTU); Mustang Island, 2½ mi S Port Aransas, 8 (UIMNH); Mustang Island, 4.8 mi S Port Aransas, 1 (TTU); Mustang Island, 4.5 mi N Access Road No. 2 on Park Road 53, 8 (TTU); Mustang Island, Access Road No. 2, 7 mi S, 4 mi W Port Aransas, 34 (TTU); Mustang Island, 9 mi S, 5 mi W Port Aransas, 11 (TTU); Mustang Island, 13 mi S Port Aransas, 1 (KU); Mustang Island, 14 mi SW Port Aransas, 5 (KU); Mustang Island, 15 mi SW Port Aransas, 5 (TCWC); Mustang Island, 19 mi S Port Aransas, 6 (TCWC); N end Padre Island, 4 (2 TCWC, 2 UIMNH); Mustang Island, 39 (7 LACM, 2 USNM, 30 TCWC). *County unknown:* Padre Island, 27 (5 AMNH, 1 BM, 13 USNM, 8 TCWC).

Geomys personatus streckeri Davis, 1940

Geomys personatus minor Davis, Texas Agric. Exp. Station Bull., 590:29, 23 October 1940 (name preoccupied by *Geomys minor* Gidley, Dept. Interior, Prof. Paper 131-E, p. 123, Dec. 26, 1922).

Geomys personatus streckeri Davis, J. Mamm., 24:508, 20 November 1943.

Holotype.—Adult female, skin and skull, TCWC 787; from Carrizo Springs, Dimmit County, Texas; collected on 24 November 1938 by William B. Davis, original no. 3239.

Measurements of holotype.—Total length, 225; length of tail, 75; length of hind foot, 30; greatest length of skull, 37.9; condylobasal length, 37.3; basal length, 34.7; palatal length, 23.5; palatofrontal depth, 13.9; length of nasals, 13.1; diastema, 11.9; zygomatic breadth, 22.3; mastoid breadth, 21.4; squamosal breadth, 17.5; rostral breadth, 8.7; interorbital constriction, 6.6; breadth across maxillaries, 7.2.

Distribution.—Restricted to Dimmit and Zavala counties, Texas, in the vicinity of Carrizo Springs and Crystal City.

Remarks.—Recent data concerning *G. p. streckeri* indicate that this taxon is unique within the species. Davis et al. (1971) reported *G. p. streckeri* to be the only subspecies of *G. personatus* to have a diploid number of 72. *G. p. streckeri* also is unique by being the only known host to the louse *Geomydoecus truncatus*; other members of *G. personatus* are parasitized by two other species of *Geomydoecus* (Price and Emerson, 1971; Timm and Price, 1979). Perhaps the most distinguishing character of *G. p. streckeri* is its small size. Williams (1982) found phallic and bacular dimensions to be smaller than those of *G. p. davisi, G. p. maritimus,* and *G. p. personatus*. Our study showed almost half of the cranial characters of both sexes to be significantly different from all other samples examined (see Table 2). These metrical differences clearly showed the uniqueness of this taxa with the MINT multivariate analysis (see sample 2 in Figs. 2 and 3). The combination of data concerning karyotypes, parasites, phalli and bacula, in addition to the univariate and multivariate (MINT) analyses, poses some interesting questions about the taxonomic status of *G. p. streckeri*. However, the BMDP-7M discriminant and canonical analyses indicate *G. p. streckeri* to be small but to have no more distinctness as a taxon than other subspecies of *G. personatus* (Fig. 4). Because these analyses involve the multivariate examination of individual specimens (instead of sample means as used by the MINT program) we have placed more value on this procedure for determining the taxonomic status of *G. p. streckeri*. Therefore, we have chosen to maintain its subspecific status at this time. Although this decision could be argued, additional data are needed to substantiate or refute our findings.

Davis (1940) reported *G. p. streckeri* to occur on a western tributary of the Nueces River at Carrizo Springs. Because *G. p. megapotamus* has been reported from the Nueces River in La Salle Co., Davis (1940) suggested that *G. p. streckeri* and *G. p. megapotamus* might come into contact along the Nueces River. Davis et al. (1971) reported additional records of *G. p. streckeri* from the east side of the Nueces River in Zavala Co. (the identification of these specimens was confirmed by karyotypic data; Davis et al., 1971). Therefore, *G. p. streckeri* and *G. p. megapotamus* currently are known to be separated by about 40 kilometers (25 miles) along the Nueces River. Further investigation is needed in Dimmit and LaSalle counties to determine if these taxa are in contact. Although our study indicated *G. personatus* in La Salle Co. to be definitely of the *megapotamus*-type, it also would be useful to learn more about that sample. Such investigations could provide information relevant to the taxonomic status of *G. p. streckeri*.

Specimens examined (74).—TEXAS. *Dimmit Co.:* 13 mi NE Carrizo Springs, 12 (TTU); Carrizo Springs, 39 (1 LACM, 31 TNHC, 7 TTU); near Carrizo Springs on Hwy. 277, 5 (TTU); 1.0 mi SW Carrizo Springs, 2 (TCWC). *Zavala Co.:* 14 mi W Crystal City, 10 (KU). *County unknown:* mouth of Sycamore Creek, 1 (USNM).

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INTRAISLAND AND INTERISLAND VARIATION IN ANTILLEAN POPULATIONS OF *MOLOSSUS MOLOSSUS* (MAMMALIA: MOLOSSIDAE)

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Abstract

Significant levels of secondary sexual variation and expected levels of individual variation were demonstrated in all samples of *Molossus molossus* from Jamaica, Guadeloupe, and Trinidad examined with univariate analyses. Significant morphometric differences were demonstrated among samples of *Molossus molossus* that originated from geographically close localities on the same island. Using multivariate techniques, broader patterns of geographic variation were demonstrated among the Antillean populations of *M. molossus*.

Introduction

The small members of the genus *Molossus* with pale-based hair occur throughout the Antilles and in adjacent areas of northern South America and Middle America. Recent authors (Husson, 1978; Jones

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et al., 1971; Koopman, 1978; Varona, 1974) have considered these populations as a single species *(Molossus molossus)*, whereas earlier authors (Miller, 1913; Hall and Kelson, 1959) have judged there to be as many as 10 species in this group.

These bats are badly in need of taxonomic revision. Earlier workers were confused by the high degree of local variation as well as geographic and secondary sexual variation. Jones et al. (1971) hypothesized that because populations were highly localized and presumably inbred, they may diverge morphologically "to a degree that mensural differences can be demonstrated even between samples from the same general geographic area." The presence of these localized populations may be at least partially responsible for the many names assigned to this group. The recently described subspecies *lambi* (Gardner, 1966) may be an example of such a local population.

Having samples of *Molossus molossus* available from the islands of Jamaica, Guadeloupe, and Trinidad in the Antilles led us to examine the degree of local as compared to geographic variation. Islands present an ideal situation for making these comparisons. Because populations on an island are potentially members of the same breeding population, demonstrable mensural differences among intraisland samples would indicate that these bats are exhibiting an unusual degree of local variation, possibly by forming local breeding demes. Presumably there is no opportunity for interbreeding among populations on widely separated islands in the Antilles; therefore, we would expect a greater variation among populations on different islands than among populations on the same island.

This paper should be viewed as the first phase of a study to clarify the systematic relationships of the small-sized members of the genus *Molossus*. The hypotheses that are tested in this study are: (1) there is no significant variation among intraisland populations of *Molossus molossus* and (2) the amount of interisland variation exceeds the amount of intraisland variation. An assessment of the amount of intraisland as compared to interisland variation should be important to future studies of geographic variation in this group, especially when mainland populations are studied.

We have not used subspecific names throughout this paper because of the taxonomic uncertainty in this group and because they are not necessary for the current study. However, currently the name *M. m. milleri* would apply to populations from Jamaica and *M. m. molossus* to populations from Guadeloupe and Trinidad (Hall, 1981:255–257).

METHODS AND MATERIALS

From all specimens, one external and nine cranial measurements were recorded. All measurements are given in millimeters and were taken by means of dial calipers as